Fishery Data Series No. 08-59

Tatlawiksuk River Salmon Studies, 2007

Annual Report for Study 07-304
USFWS Office of Subsistence Management
Fisheries Information Services Division

by

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December 2008

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	\$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye to fork	MEF
mideye to tail fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	log_2, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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December 2008

Development and publication of this manuscript was partially financed by the USFWS Office of Subsistence Management (Project 07-304) Fisheries Resource Monitoring Program under Agreement 701817J647. Matching funds were provided by Coastal Villages Region Fund and the State of Alaska.

ADF&G Fishery Data Series was established in 1987 for the publication of Division of Sport Fish technically oriented results for a single project or group of closely related projects, and in 2004 became a joint divisional series with the Division of Commercial Fisheries. Fishery Data Series reports are intended for fishery and other technical professionals and are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm This publication has undergone editorial and peer review.

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This document should be cited as:
Stewart R., D. J. Costello, D. B. Molyneaux, and J. M. Thalhauser. 2008. Tatlawiksuk River salmon studies, 2007. Alaska Department of Fish and Game, Fishery Data Series No. 08-59, Anchorage.

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ABSTRACT

The Tatlawiksuk River is a tributary of the Kuskokwim River, and produces Chinook salmon *Oncorhynchus tshawytscha*, chum salmon *O. keta*, and coho salmon *O. kisutch* that contribute to important subsistence and commercial salmon fisheries downstream of its confluence. The Tatlawiksuk River weir is one of several projects operated in the Kuskokwim Area that form an integrated geographic array of escapement monitoring projects. Collectively, and in accordance with the State of Alaska's Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222), this array of projects is a tool used to ensure appropriate geographic and temporal distribution of spawners, and provide a means to assess trends in escapement that should be monitored and considered in harvest management decisions. Towards this end, Tatlawiksuk River weir has been operated annually since 1998 to determine daily and total salmon escapements for the target operational period of 15 June through 20 September; to estimate age, sex, and length compositions of Chinook, chum, and coho salmon escapement; to monitor environmental variables that influence salmon productivity; and to serve as part of an integrated platform in support of other Kuskokwim Area fisheries projects.

In 2007, a resistance board weir was successfully operated on the Tatlawiksuk River from 15 June through 15 September, at which time anticipated high water levels necessitated early removal of the weir. Daily passage estimates were calculated to span the remainder of the target operational period. Escapements of 2,061 Chinook, 83,246 chum, 27 sockeye *O. nerka*, and 8,685 coho salmon were determined for the target operational period in 2007. Formal escapement goals do not exist for the Tatlawiksuk River; however, Chinook salmon escapement was above average, chum salmon escapement exceeded all previous years, and coho salmon escapement was near average. Historically, so few sockeye salmon have been observed in the Tatlawiksuk River that the escapement of 27 fish in 2007 was actually above average. Age, sex, and length (ASL) samples were collected from 13.3% of the Chinook escapement, 1.1% of the chum escapement, and 4.8% of the coho salmon escapement. The Chinook salmon escapement consisted of 43.9% age-1.3 fish, 34.7% age-1.2 fish, 19.7% age-1.4 fish, and 27.2% females. The chum salmon escapement consisted of 80.2% age-0.3 fish, 15.8% age-0.4 fish, 3.3% age-0.2 fish, and 52.3% females. The coho salmon escapement consisted of 88.3% age-2.1 fish, 6.8% age-3.1 fish, and 4.9% age-1.1 fish. In addition to enumerating escapement and estimating ASL composition the weir served as a platform for several other projects including *Kuskokwim River Chinook Salmon Run Reconstruction* and *Kuskokwim River Sockeye Salmon Investigations.* The Tatlawiksuk River weir successfully contributed to each of these projects in 2007.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, chum salmon, *O. keta*, coho salmon, *O. kisutch*, longnose suckers, *Catostomus catostomus*, escapement, age-sex-length, ASL, Tatlawiksuk River, Kuskokwim River, resistance board weir, radiotelemetry, mark–recapture, stock specific run timing, upper Kuskokwim.

INTRODUCTION

The Kuskokwim River is the second largest river in Alaska, draining an area approximately 130,000 km^2, or 11% of the total area of Alaska[1] (Figure 1). Each year mature salmon *Oncorhynchus spp.* return to the river to spawn, supporting an annual average subsistence and commercial harvest of nearly 1 million salmon (Whitmore et al. 2008). The subsistence salmon fishery in the Kuskokwim Area is one of the largest and most important in the state[2] (ADF&G 2004; Coffing 1991, Coffing et al. 2001; Smith et al. *In prep*; Ward et al. 2003; Whitmore et al. 2008) and remains a fundamental component of local culture. The commercial salmon fishery, though modest in value compared to other areas of Alaska, has been an important component of the market economy of lower Kuskokwim River communities (Buklis 1999; Whitmore et al. 2008). Salmon that contribute to these fisheries spawn and rear in nearly every tributary of the Kuskokwim River basin.

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1 Draft report, by C. M. Brown, 1983. *Alaska's Kuskokwim River region: a history*, Bureau of Land Management, Anchorage.

2 Unpublished reports authored by M. Coffing of the Alaska Department of Fish and Game, Division of Subsistence, Bethel, Alaska: *Kuskokwim area subsistence salmon harvest summary, 1996*; prepared for the Alaska Board of Fisheries, Fairbanks, Alaska, December 2, 1997; and *Kuskokwim area subsistence salmon fishery*; prepared for the Alaska Board of Fisheries, Fairbanks, Alaska, December 2, 1997.

Since 1960, management of Kuskokwim River subsistence, commercial, and sport fisheries has been the responsibility of the Alaska Department of Fish and Game (ADF&G). Management authority for the subsistence fishery was broadened in October 1999 to include the federal government under Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA). The U.S. Fish and Wildlife Service (USFWS) is the federal agency most involved within the Kuskokwim Area and tribal groups such as the Kuskokwim Native Association (KNA) are charged by their constituency to actively promote a healthy and sustainable subsistence salmon fishery. These and other groups have combined their resources to develop projects such as the Tatlawiksuk River weir to better achieve the common goal of providing for long-term sustainability of salmon fisheries in the Kuskokwim River.

The goal of salmon management is to provide for long-term sustainable fisheries by ensuring that adequate numbers of salmon escape to the spawning grounds each year. This goal requires an array of long-term escapement monitoring projects that reliably measure annual escapement to key spawning systems as well as track temporal and spatial patterns in abundance that influence management decisions. Over time and with sufficient data, escapement goals can be developed as a means to gauge escapement adequacy, but current spawner-recruit models for escapement goal development require many years of data. In the Kuskokwim River, only 2 long-term, ground-based escapement monitoring projects have operated reliably for more than 10 years (Whitmore et al. 2008). Of the dozens of tributaries known to support spawning populations of salmon, the presence of escapement-monitoring projects on 2 tributaries clearly does not provide adequate escapement information for the entire Kuskokwim River basin. This deficiency was improved with the inception of several additional projects in the mid to late 1990s, including the Tatlawiksuk River weir. The data provided by the current array of projects have much greater utility for fishery managers and have decreased their reliance on aerial stream surveys which are known to be less reliable (Whitmore et al. 2008). The inception of the Tatlawiksuk River weir in 1998, coupled with other projects initiated within the last 15 years (Costello et al. 2008; Schaberg et al. *In prep*; Stroka and Brase 2004; Stuby 2007; Thalhauser et al. *In prep*), provides some of the additional escapement and abundance estimates required for effective management (Holmes and Burkett 1996; Mundy 1998).

In recent years, Kuskokwim River Chinook *O. tshawytscha* and chum *O. keta* salmon have received considerable attention by the Alaska Board of Fisheries (BOF) due to erratic run abundance patterns. The BOF designated Kuskokwim River Chinook and chum salmon as "stocks of yield concern" in 2000 due to the chronic inability of managers to maintain expected harvest levels (Burkey et al. 2000a, b; Ward et al. 2003). This "stock of yield concern" designation was upheld during the 2004 BOF meeting but was cancelled during the 2007 BOF meeting at the recommendation of ADF&G following several years of expected harvest levels and relatively strong escapements (Bergstrom and Whitmore 2004; Molyneaux and Brannian 2006). Between 2001 and 2006 subsistence and commercial fisheries were managed conservatively and in accordance with the BOF "stocks of yield concern" designations. Efforts were focused on enumerating abundance of these species and obtaining enough data for escapement goal development. Several main-river and regional projects arose that utilized the existing weir infrastructure for data collection. Such projects have since become deeply integrated components of field operations.

Although salmon production is modest, the Tatlawiksuk River contributes to sustainable fisheries both by adding to the annual production and by adding to genetic diversity similar to what

Hilborn et al. (2003) described for Bristol Bay. Since fishers tend to harvest fish from the early part of the salmon runs and the early part of the runs may be dominated by upper river salmon stocks, salmon production from the upper Kuskokwim River may support a disproportionately high fraction of the subsistence harvest, particularly for Chinook salmon (Schaberg et al. *In prep*). This latter point makes monitoring upper Kuskokwim River salmon escapements, such as on the Tatlawiksuk River, a particularly important tool for maintaining long-term sustainability of the downriver fisheries.

The utility of weirs extends beyond providing annual escapement estimates. Escapement projects, such as the Tatlawiksuk River weir, commonly serve as platforms for collecting other types of information useful for management and research. Collection of age, sex, and length (ASL) data are typically included in most escapement monitoring projects, and the Tatlawiksuk River weir is no exception (Molyneaux et al. *In prep*). Knowledge of ASL composition can provide and improve understanding of fluctuations in salmon abundance and is essential in developing spawner-recruit relationships used in formulating escapement goals (DuBois and Molyneaux 2000).

The Tatlawiksuk River weir also serves as a platform for collecting information on habitat variables including water temperature, water chemistry, and stream discharge (level), which are fundamental variables of the stream environment that directly or indirectly influence salmon productivity and timing of salmon migrations (Hauer and Hill 1996; Kruse 1998; Quinn 2005). Since these variables can be affected by human activities (i.e., mining, timber harvesting, greenhouse gas emissions, man-made impoundments, etc.; NRC 1996) or climatic variability (e.g., El Nino and La Nina events), data collection for such variables are included in the project operational plan.

BACKGROUND

A tributary of the middle Kuskokwim River basin, the Tatlawiksuk River provides spawning and rearing habitat for Chinook, chum, and coho salmon (ADF&G 1998) and has a history of subsistence use. According to Elders of nearby communities, Athabaskan groups routinely harvested salmon from the Tatlawiksuk River until the mid 1900s (Andrew Gusty Sr., Resident, Stony River village; personal communication). Periodically during the last 40 years ADF&G biologists have observed salmon escapements in the mainstem Tatlawiksuk River during aerial surveys[3] (Burkey and Salomone 1999).

Salmon escapement monitoring began at the Tatlawiksuk River in 1998 through the joint effort of Kuskokwim Native Association and ADF&G (Linderman et al. 2002). Unfortunately, operations in 1998 were incomplete and the fixed-panel weir design was replaced with a resistance board weir in 1999, which improved performance in subsequent years. Since then, the Tatlawiksuk River weir has been collecting escapement and ASL composition information on Chinook, chum, coho, and sockeye salmon escapement; habitat and climatic variables; and has served as a platform for other collaborative research efforts.

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[3] Unpublished report by D. J. Schneiderhan, Alaska Department of Fish and Game, Division of Commercial Fisheries; Anchorage; *Kuskokwim stream catalog, 1954-1983*.

OBJECTIVES

The annual objectives for the Tatlawiksuk River escapement monitoring project (FIS 07-304) were to:

1. Determine daily and total annual Chinook, chum, and coho salmon escapements to Tatlawiksuk River from 15 June to 20 September;
2. Estimate the age, sex, and length composition of annual Chinook, chum, and coho salmon escapements to the Tatlawiksuk River such that simultaneous 95% confidence intervals of age composition are no wider than 0.20 ($\alpha = 0.05$, $d = 0.10$);
3. Monitor habitat variables including daily water temperature, water level, and stream discharge;
4. Provide mentorship and administer education curriculum to KNA high school interns; and,
5. Serve as a platform to facilitate current and future fisheries research projects by:
    a. Serving as a monitoring location for Chinook salmon equipped with radio transmitters and anchor tags deployed as part of *Kuskokwim River Chinook Salmon Run Reconstruction*; and,
    b. Serving as a monitoring location for sockeye salmon equipped with radio transmitters deployed as part of *Kuskokwim River Sockeye Salmon Investigations*.

The primary goal of this report is to summarize and present the results for the 2007 field season at the Tatlawiksuk River weir. Secondary to this, we intend to provide a more holistic perspective of Kuskokwim Area fisheries by placing the 2007 findings into the broader spatial and temporal context. To do this we draw heavily on data from past years at this project to highlight between year trends, and we draw on data from other escapement monitoring projects, related research projects, and commercial and subsistence fisheries to highlight spatial trends. These goals are intended to enhance the utility of this report beyond simply archiving data. It is important to note that some of the data used to make these broader comparisons are preliminary and effort was made to ensure that all preliminary data was reported as such. In addition, many of the referenced documents are currently being developed. Consequently, most of the reported trends for other projects were determined by the authors of this report based on finalized data sets generously provided by other researchers. At the time of writing of this document all reported estimates and trends are as accurate as possible; however, the final results and conclusions for "*In prep*" documents might have changed. This highlights the importance for readers to consult the original documents prior to referencing results from other projects. Furthermore, unless stated, the statistical significance of the trends discussed for this and other escapement monitoring projects have not been determined. Many of these trends are subjective and based on low sample sizes with high variance. It is important to remember that sampling methodologies may differ across projects and over time leading to difficulty in comparisons. Throughout this document every effort was made to ensure sound comparisons; however, the reader should be aware of these potential issues and receive broader spatial and temporal trends with caution.

METHODS

STUDY AREA

Tatlawiksuk River originates in the foothills of the Alaska Range and flows southwesterly for 113 km, draining an area of approximately 2,106 km^2 before joining the Kuskokwim River at river kilometer (rkm) 563 (Figure 2). Throughout most of the river's course, it meanders across wide, flat valleys vegetated with white spruce and scattered birch or aspen. Black spruce is more characteristic in poorly drained areas of the basin, and dense stands of willow and alder occur on sand and gravel bars. Unnamed streams that join the Tatlawiksuk River from the southeast and northeast drain extensive bog flats and swampy lowlands in the lower reaches of the basin. The channel gradient of the lower 80 km is approximately 1.5 m per km[4].

WEIR DESIGN

Installation Site

The Tatlawiksuk River weir site is located approximately 16 rkm upstream from Sinka's Landing (Gregory family homestead), 32 rkm from the village of Stony River, and 568 rkm from the mouth of the Kuskokwim River (Figures 1 and 2). At the weir site, the Tatlawiksuk River is about 64 m wide and has a depth of about 1 m during normal summer operations. The weir is positioned in the center of a wide bend, adjacent to a high cut bank to the east and a small floodplain to the west. Dense patches of alder and willow suggest that the floodplain is at an intermediate stage of succession, and terracing of the floodplain indicates that the stream channel has shifted course many times. The floodplain is interspersed with small channels that remain isolated except in periods of extreme high water, presumably during the spring runoff. Areas further downstream are considered unsuitable due to excessive water depth, poor stream and bank profile, and poor substrate type.

Construction

The Tatlawiksuk River weir is termed a "floating panel" resistance board weir. Tobin (1994) describes details of the design and construction and Stewart (2002) describes the changes implemented for the Tatlawiksuk River weir. Each year the weir is installed across the entire 210 ft (64 m) channel following the techniques described by Stewart (2003). The substrate rail and resistance board panels cover the middle 190 ft (58 m) portion of the channel, and fixed weir materials extend the weir 10 ft (3 m) to each bank. The pickets are 1-5/16 in (3.33 cm) in diameter and spaced at intervals of 2-5/8 in (6.67 cm) to leave a gap of 1-5/16 in (3.33 cm) between each picket.

Most fish passage intentionally occurs through the fish trap, which is annually installed within the deeper portion of the stream channel. The fish trap is about 2.5 m long (parallel to channel) and 1.5 m wide (perpendicular to channel) and has 2 gates: 1 facing downstream and 1 facing upstream. After all the panels are installed across the river, 1 is removed where the trap is to be installed and modified weir panels are fastened to the side of each panel adjacent the gap. The trap is lowered into the river just upstream of the rail with its downstream gate centered on the gap. The modified panels are butted against the trap frame and maintain the weir's integrity. The trap can be easily configured to pass fish freely upstream or to capture individuals for sampling.

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[4] Draft report, by C. M. Brown, 1983. *Alaska's Kuskokwim River region: a history*, Bureau of Land Management, Anchorage.

A skiff gate is installed within a deeper section of the river to facilitate both jet-driven and propeller-driven boat traffic. The skiff gate consists of panels modified to submerge under the weight of passing boats. Generally, boat operators can pass with little or no involvement with the weir crew. Boats with jet-drive engines are the most common and could pass up or downstream over the skiff gate after reducing speed to 5 miles per hour or less.

To accommodate downstream migration of longnose suckers *Catastomas catostomas* and other resident species, downstream passage chutes are incorporated into the weir once resident species are observed congregating upstream. At locations where downstream migrants are most concentrated, chutes are created by releasing the resistance boards on 1 or 2 adjacent weir panels so the distal ends dip slightly below the stream surface. The chute's shallow profile guides downstream migrants, but prevents upstream salmon passage. The chutes are monitored and adjusted to ensure salmon are not passing upstream. Downstream salmon passage is not enumerated; however, few salmon have been observed passing downstream over these chutes and their numbers are not considered significant.

Maintenance

The weir is cleaned once or twice each day, typically at the end of a counting shift. To clean the weir, a technician walks along the floating end. This added weight on the distal end partially submerges each panel and allows the current to wash debris downstream. A rake is used to push larger debris off the weir. Each time the weir is cleaned panels and other weir components are inspected for damage. Periodically, a more thorough inspection is performed by snorkeling along the rail.

Escapement Monitoring

The Tatlawiksuk River weir operates according to a "target operational period" that encompasses virtually the entire runs of Chinook, chum, and coho salmon. Having a target operational period provides for consistent comparisons among years. The target operational period for Tatlawiksuk River weir has been established as 15 June through 20 September. Annual operational dates may vary due to stream conditions and anomalies in run timing and/or abundance. Reported daily and annual Chinook, chum, coho, and sockeye salmon escapements consist of observed plus any estimated passage. Counts of all other species, including pink salmon, are reported as observed passage; expected missed passage is not estimated.

Passage Counts

Passage counts are conducted periodically during daylight hours. Substantial delays in fish passage occur only at night or during ASL sampling. Crew members visually identify each fish as it passes upstream and record it by species on a multiple tally counter. Counting continues for a minimum of 1 hour or until passage substantially decreases. Counting effort is adjusted as needed to accommodate the migratory behavior and abundance of fish, or operational constraints such as reduced visibility in evening hours late in the season. Crew members record the total upstream fish count in a designated notebook and zero the tally counter after each counting session. At the end of each day, total daily and cumulative seasonal counts are copied to logbook forms. These counts are reported each morning to ADF&G staff in Bethel via single side band radio or satellite telephone.

The live trap is used as the primary means of upstream fish passage. Fish are counted as they enter the downstream end of the trap. Proper identification is enhanced by use of a clear-bottom viewing box that reduces glare and water turbulence. In addition to aiding in species identification, this tool allows observers to see and trap tagged fish in support of tagging projects, such as *Kuskokwim River Chinook Salmon Run Reconstruction* and *Kuskokwim River Sockeye Salmon Investigations* in 2007. Other methods are occasionally used when salmon are reluctant to enter the fish trap, such as during periods of extreme low water (Costello et al. 2007).

Estimating Missed Passage

To better assess annual run size of each species of salmon and to facilitate comparison among years, upstream salmon passage is estimated for days when the weir is not operational within the target operational period. When historical data indicate that passage of a particular species on an inoperable day is probably negligible, passage is assumed to be zero without performing any calculations. However, when historical records indicate that passage of a particular species is probably considerable, 1 of the 3 formulas listed below are used to calculate potential missed passage. The method used depends on the duration and timing of the inoperable periods.

Single Day Method

When the weir is not operational for part or all of 1 day, an estimate for the inoperable day is calculated using the following formula:

$$\hat{n}_{d_i} = \left(\frac{\left(n_{d-2} + n_{d-1} + n_{d+1} + n_{d+2}\right)}{4} \right) - n_{o_i} \tag{1}$$

Where

$n_{d_I-1}, n_{d_I-2} =$ observed passage of 1, 2 days before the weir was washed out;

$n_{d_I+1}, n_{d_I+2} =$ observed passage of 1, 2 days after the weir was reinstalled; and,

$n_{o_i} =$ observed passage (if any) from the given day (i) being estimated.

Linear Method

When the weir is inoperable for 2 or more days and later became operational, passage estimates for the inoperable days are calculated using the following formula:

$$\hat{n}_{d_i} = (\alpha + \beta \cdot i) - n_{o_i} \tag{2}$$

$$\alpha = \frac{n_{d_1-1} + n_{d_1-2}}{2}$$

$$\beta = \frac{\left(n_{d_I+I} + n_{d_I+I+1}\right) - \left(n_{d_1-1} + n_{d_1-2}\right)}{2(I+1)}$$

where

$I =$ number of inoperative days ($I > 2$), and

$n_{d_I+I}, n_{d_I+I+1} =$ observed passage the first day after the weir was reinstalled.

Proportion Method

In circumstances when the weir does not first become operational until after the target start date (15 June) or when the weir ceases operating before the target end date (20 September) daily passage for inoperable days is estimated using passage data from another year at the George River weir or from the present year at a neighboring project. The dataset used to model escapement for a particular situation is selected because it exhibits similar passage patterns to the incomplete dataset. With this method, daily passage estimates are calculated using the following formula:

$$\hat{n}_{d_i} = \left(\frac{\left(n_{md_i} \times \sum n_{d_1} \right)}{\sum n_{md_1}} \right) - n_{o_i} \tag{3}$$

where

n_{md_i} = passage for the i^{th} day in the model data;

$\sum n_{d_1}$ = cumulative passage;

$\sum n_{md_1}$ = cumulative passage of the model data for the corresponding time period; and,

n_{o_i} = observed passage (if any) from the given day (i) being estimated.

Estimates Required in 2007

Presented here in chronological order, the "single-day" method was used to estimate passage on 19 July due to the presence of a hole, the "linear-method" was used to estimate passage during the inoperable period that occurred between 6 and 11 August, and the "proportion" method was used to estimate passage between 16 and 20 September after the weir had been removed early. Passage estimates for 16–20 September were only necessary for coho salmon; daily passage of other species had dropped to zero long before. Tatlawiksuk River weir coho salmon escapement data from 2004 was chosen as a model data set for estimating coho salmon passage during this time.

Carcasses

Spawned out and dead salmon (hereafter referred to as carcasses) that washed up on the weir were counted by species and sex and passed downstream. Daily carcass counts were recorded in the camp log.

AGE, SEX, AND LENGTH COMPOSITION

Age, sex, and length compositions of the total annual Chinook, chum, and coho salmon escapements were estimated by sampling a fraction of fish passage and applying the ASL composition of those samples to the total annual escapement (DuBois and Molyneaux 2000).

Sample Collection

The crew at the Tatlawiksuk River weir employed standard sampling techniques as described by DuBois and Molyneaux (2000). For chum and coho salmon a pulse sampling design was used in which sampling was conducted for 1 to 3 days followed by a several days without sampling. The goal was to obtain a minimum of thee pulse samples (one from each third of the run) to account for temporal dynamics in ASL composition. The intended pulse sample size was 200 for chum salmon and 170 for coho salmon.

The pulse sample design commonly used at other locations for Chinook salmon was not implemented at the Tatlawiksuk River weir in 2007 due to their low abundance relative to chum salmon. In the past, crews attempted to sample 210 Chinook salmon in 3 pulses but in 2007 a modest escapement of Chinook salmon coupled with a high escapement of chum salmon made this strategy impractical. As a result, limited sampling was conducted nearly every day the weir was operational through the Chinook salmon run. Sampling effort was greatest during periods of high Chinook salmon passage to maximize sample collection while minimizing the effects of sampling on chum salmon migration past the weir.

Whether they were total season sample sizes as with Chinook salmon or pulse sample sizes as with chum and coho salmon, sample sizes were selected so that the simultaneous 95% confidence interval estimates of age and sex composition proportions would be no wider than 0.20 (Bromaghin 1993). Investigators assumed 10 age/sex categories for Chinook salmon, 8 age/sex categories for chum salmon, and 6 age/sex categories for coho salmon. Target sample sizes for all species were increased by about 10% from those recommended by Bromaghin (1993) to account for scales that could not be aged. For chum and coho salmon, the goal was to collect at least 3 pulse samples. For Chinook salmon, the goal was to sample nearly every day throughout the run. Either strategy would reveal temporal changes in ASL composition.

Salmon were sampled from the fish trap installed in the weir. The trap included an entrance gate, holding pen, and exit gate. On days when sampling was conducted, the entrance gate was opened while the exit gate remained closed, allowing fish to accumulate inside the 8 by 5 ft (2.4 by 1.5 m) holding pen. The holding pen was typically allowed to fill with fish and sampling was conducted during scheduled counting periods. Every fish of the target species was measured for length to the nearest millimeter from the center of the eye (mid eye) to tail fork (METF) and identified as male or female through visual examination of the external morphology. Depending on the species being sampled 1 or 3 scales were removed from the preferred area of the fish (INPFC 1963). Scales were affixed to gum cards and sent to ADF&G staff for processing (i.e. age determination). Detailed sampling methods were similar to those described by Stewart and Molyneaux (2005).

Additional Chinook samples were collected through active sampling, which consisted of capturing and sampling Chinook salmon while actively passing and enumerating all fish. Further details of the active sampling procedures are described in Linderman et al. (2002). This method was also used for tag recoveries.

After sampling was completed, relevant information such as sex, length, date, and location was copied from hardcopy forms to computer mark–sense forms. The completed gum cards and data forms were sent to the Bethel and Anchorage ADF&G offices for processing. The original ASL gum cards, acetates and mark–sense forms were archived at the ADF&G office in Anchorage. The computer files were archived by ADF&G in the Anchorage and Bethel offices. Data were also loaded into the Arctic-Yukon-Kuskokwim (AYK) salmon database management system (Brannian et al. 2005).

Estimating Age, Sex, and Length Composition of Escapement

ADF&G staff in Bethel and Anchorage aged scales, processed the ASL data, and generated data summaries. DuBois and Molyneaux (2000) describe details of the processing and summarizing procedures. These procedures generated 2 types of summary tables for each species: one described the age and sex composition and the other described length statistics. These summaries account for changes in the ASL composition throughout the season by first partitioning the season into temporal strata, applying the ASL composition of individual temporal samples to the corresponding temporal strata, and finally summing the strata to generate the estimated ASL composition for the season. This procedure ensures that the ASL composition of the total annual escapement is weighted by abundance of fish in the escapement rather than the abundance of fish in the samples. For example, if samples of coho salmon were collected in 3 pulses, then the season would be partitioned into 3 temporal strata with 1 pulse sample occurring in each stratum. A sample of 140 coho salmon collected from 3 to 6 September would be used to estimate the ASL composition of the 400 coho salmon that passed the weir during the temporal strata that spanned 2 to 7 September. This procedure would be repeated for each stratum, and the estimated age and sex composition for the total annual escapement would be calculated as the sum of coho salmon in each stratum. In similar fashion, the estimated mean length composition for the total annual escapement would be calculated by weighting the mean lengths in each stratum by the escapement of coho salmon that passed the weir during that stratum. Confidence intervals were constructed for the estimated mean lengths according to Thompson (1992; page 105).

Throughout this document, fish ages are reported using European notation (2 numerals separated by a decimal). The first numeral indicates the number of winters the juvenile spent in the stream environment and the second indicates the number of winters spent in the ocean (Groot and Margolis 1991). Total age of a fish is equal to the sum of both numerals plus 1 year to account for the winter when the egg was incubating in gravel. For example, a Chinook salmon described as an age-1.4 fish is actually 6 years of age. European notation will be used throughout this document to represent specific age classes and fish with a particular life history strategy. Total age will be used when discussing brood size because broods often consist of same age fish with different life history strategies. For example a brood of age-6 Chinook salmon may consist of age-1.4 and age-2.3 fish.

WEATHER AND STREAM OBSERVATIONS

Weather and stream observations were taken in the morning and usually again in the late afternoon to monitor habitat variables. Air and water temperatures (in °C) were measured using a calibrated thermometer. Air temperatures were obtained from a thermometer mounted semi-permanently in the shade near the cabin and stream temperature was determined by submerging the thermometer below the water surface until the temperature reading stabilized. Temperature readings were recorded in the logbook, along with notations about cloud cover, wind direction, wind speed, and precipitation. Wind speed was estimated to the nearest 5 miles per hour, and daily precipitation was measured (in millimeters) using a calibrated rain gauge. As in 2006 and 2005, water temperature readings were also obtained using a Hobo® Water Temp Pro data logger installed at mid channel near the stream bottom. The data logger was programmed to record water temperature every hour (on the hour) during the weir operational period. Records were retrieved at the end of the season and archived for future comparisons.

Water level observations represented the stream height in centimeters above an arbitrary datum plane. Water levels were measured using a staff gage installed about 150 meters downstream from the weir. The staff gage, which is installed annually, was calibrated to a reliable benchmark installed in 2005 (Stewart et al. 2006; Appendix D3), which replaced semi-permanent benchmarks installed in previous years (Stewart and Molyneaux 2005).

KNA HIGH SCHOOL INTERNSHIP PROGRAM

Local area high school students were recruited to spend 1 or 2 weeks at various KNA fisheries projects including the Tatlawiksuk River weir. Students participated in passage counts, ASL sample collections, and weather and stream measurements under the supervision of project crew members. In addition, crew administered a curriculum of daily educational assignments and field activities. The curriculum was developed by consulting Kuspuk School District (KSD) teachers and is a melding of the Alaska state high school science and math standards with lessons about fish biology and ecology, fisheries research, subsistence living, and fisheries management. Students were paid $250 per week if they successful completed the internship. Detailed methods of the KNA Natural Resources Internship Program are described in Orabutt and Diehl (2006).

RELATED FISHERIES PROJECTS

Kuskokwim River Chinook Salmon Run Reconstruction

The Tatlawiksuk River weir was a component of a basinwide project entitled *Kuskokwim River Chinook Salmon Run Reconstruction,* henceforth referred to as "the Run Reconstruction project". The project utilized existing telemetry and tagging infrastructure installed in support of Sport Fish Division's *Inriver Abundance of Chinook Salmon in the Kuskokwim River*, henceforth referred to as "the Inriver Abundance project", and Division of Commercial Fisheries' *Kuskokwim River Sockeye Salmon Investigations* (described below), and *Kuskokwim River Salmon Mark–Recapture Project* (FIS 04-308), henceforth referred to as the "Mark–Recapture project".

Objectives of the Run Reconstruction project included investigating the relationship between drainagewide abundance estimates and known tributary escapements to derive a statistical model that would compute historical annual abundance estimates based on known tributary escapements. The Inriver Abundance project provided abundance estimates for each year between 2002 and 2006, but to increase the power of the model and since the infrastructure was already in place investigators decided to continue radio-tagging and anchor-tagging Chinook salmon in 2007 to derive another annual abundance estimate. As with *Inriver Abundance of Chinook Salmon in the Kuskokwim River*, radio transmitters were inserted into select Chinook salmon with lengths greater than 450 mm caught near upper Kalskag (rkm 270) following methods described by Stuby (2007). Radio-tagged fish were detected by several tracking stations spread throughout the drainage and every weir was accompanied by a tracking station. Radio-tags are not visible when fish are viewed from the top, so every radio-tagged fish was fitted with an anchor-tag that allowed weir crews to identify and trap radio-tagged fish for tag number recovery. This system of weirs and tracking stations allowed for: (1) the development of tagged-to-untagged ratios, (2) a means to test potential tagging bias, and (3) the development of annual abundance estimates for most of the drainage.

The Run Reconstruction project utilized data obtained from the Inriver Abundance project and most of the methods used by the latter were implemented into the experimental design of the former; however, additional attention was given to the Aniak River drainage for which previous abundance data were thought unreliable. In 2006 and 2007, a weir and tracking station were installed on the Salmon River tributary of the Aniak River to generate a tagged-to-untagged ratio assumed to be representative of the entire drainage. Consequently, abundance estimates are being generated for the Aniak River.

The location of the tracking station relative to the weir differed slightly at each weir location. At the Tatlawiksuk River weir site, the receiver station was placed on the bank in-line with the weir. Due to the orientation of the receiver station to the weir, fish were detected passing the receiver station at precisely the same time they passed upstream of the weir. The known Chinook salmon passage at the weir, coupled with data collected from the receiver station, were used with similar data collected at other weir projects to develop estimates of the total Chinook salmon abundance upstream from the Kalskag tagging site.

Kuskokwim River Sockeye Salmon Investigations

The Tatlawiksuk River weir was used as a platform for the project entitled *Kuskokwim River Sockeye Salmon Investigations*. This project was designed to address critical knowledge gaps in the biology and ecology of Kuskokwim River sockeye salmon. Specifically, this project aimed to describe the location and relative abundance of sockeye salmon spawning aggregates, estimate stock-specific run-timing in the main stem of the Kuskokwim River, describe and compare habitat use and seasonal migration patterns of river-type and lake-type juveniles, and describe and compare smolt size and growth among tributaries and habitat types. These goals were addressed by conducting a 2-sample mark–recapture study of the Kuskokwim River drainage above Kalskag, and juvenile studies in the Holitna River and at Telaquana Lake within the Stony River drainage.

Similar to the Chinook project, radio transmitters were inserted into sockeye salmon caught near Kalskag. Radiotagged fish were also equipped with an anchor-tag to assess incidences of tag loss. A combination of radio receiver stations located throughout the upper Kuskokwim River drainage (the same receiver stations used for the Chinook project) and aerial surveys was used to monitor the movement of tagged fish. In 2006, juvenile salmon were sampled from various habitat types throughout the Holitna drainage using standard seining techniques. The known sockeye salmon passage at the weir projects located throughout the upper drainage, coupled with data collected from tracking efforts, was used to address distribution, abundance, and run-timing of spawning aggregates. Data from seining efforts were used to address habitat use, out migration timing, and variation in size and growth of juvenile sockeye salmon.

RESULTS

Escapement Monitoring

Installation of the Tatlawiksuk River weir began on 9 June and was complete at 2100 hours on 13 June, more than a day before the target operational date. Weir removal began on 16 September and was completed on 18 September. Weir integrity was breached 4 times during the target operational period. Holes were discovered on 19 July and 10 September, requiring the calculation of an estimate for those days ("single-day" method). Estimates were required for the last 5 days of the target operational period (16–20 September) because the weir was removed early due to relatively low coho salmon passage and anticipated water level increases. The most consequential breach occurred between 6 and 11 August when water levels exceeded the operational limit for the weir.

Chinook Salmon

A total of 2,061 Chinook salmon passed upstream of the Tatlawiksuk River weir during the target operational period in 2007 (Table 1). Passage estimates were required on 19 July and 10 September when holes were discovered, and every day between 6 and 11 August when water remained above the trap. Combined, daily passage estimates amounted to 1.6% of the annual escapement in 2007. The first Chinook salmon was observed on 25 June and the last was observed on 6 September, 10 days before the weir became inoperative (Table 1). Daily passage peaked at 488 on 9 July. Based on total estimated escapement during the target operational period, the median passage date was 9 July and the central 50% of the run occurred between 8 and 14 July (Table 1; Figure 3).

Chum Salmon

A total of 83,246 chum salmon passed upstream of the Tatlawiksuk River weir during the target operational period in 2007 (Table 1). Passage estimates were required on 19 July and 10 September when holes were discovered, and every day between 6 and 11 August when water remained above the trap. Combined, daily passage estimates amounted to 4.6% of the annual escapement in 2007. The first chum salmon was observed on 20 June and the last was observed on 13 September, 2 days before weir removal began (Table 1). Daily passage peaked at 5,069 on 9 July. Based on total annual escapement during the target operational period, the median passage date was 16 July and the central 50% of the run occurred between 10 July and 23 July (Table 1; Figure 3).

Coho Salmon

A total of 8,685 coho salmon passed upstream of the Tatlawiksuk River weir during the target operational period in 2007 (Table 1). Passage estimates were required on 19 July and 10 September when holes were discovered, and every day between 6 and 11 August when water remained above the trap. Passage was estimated for the remainder of the target operational period after the last day of weir operation on 15 September. Combined, daily passage estimates amounted to 16.9% of the annual escapement in 2007. The first coho salmon was observed on 19 July and the last was observed on 15 September, the last day of weir operation (Table 1). Using the "proportion method" and 2004 as the model data set daily passage estimates dropped to zero on 19 September. Daily passage peaked at 500 on 21 August. Based on total annual escapement during the target operational period, the median passage date was 18 August and the central 50% of the run occurred between 12 July and 25 July (Table 1; Figure 3).

Sockeye Salmon

A total of 27 sockeye salmon passed upstream of the Tatlawiksuk River weir during the target operational period in 2007 (Table 1). Passage estimates were required on 19 July and 10 September when holes were discovered, and every day between 6 and 11 August when water remained above the trap. Combined, daily passage estimates amounted to 7.4% of the annual escapement in 2007. The first sockeye salmon was observed on 22 July the last was observed on 6 September. Based on total estimated escapement during the target operational period, the median passage date was 4 August and the central 50% of the run occurred between 28 July and 18 August.

Other Species

Pink Salmon

Pink salmon *O. gorbuscha* are rare in the Tatlawiksuk River. A total of 7 pink salmon were observed passing upstream in 2007 (Appendix A1). Estimates were not made for pink salmon since they constitute only a minute fraction of total salmon escapement. The first and last pink salmon were observed on 16 July and 27 July.

Resident Species

Four resident fish species were observed passing upstream of the weir in 2007. Longnose suckers were the most abundant, with 1,241 passing the weir during the operational period (Appendix A1). Other fish observed passing upstream of the weir in 2007 included 27 whitefish *Coregonus sp.*, 13 northern pike *Esox lucius*, and 5 Arctic grayling *Thymallus arcticus* (Appendix A1). No estimates were made for resident fish passage when the weir was inoperative.

Carcasses

A total of 1,804 salmon carcasses were recovered on the Tatlawiksuk River weir in 2007 (Appendix C1). Chum salmon were the largest constituent of the total carcass recovery (1,762), followed by Chinook (37), coho (3), and sockeye salmon (2). No pink salmon carcasses were recovered. Females comprised 26.4% of the chum salmon carcasses and 21.6% of the Chinook salmon carcasses; all recovered coho and sockeye salmon carcasses were males (Appendix C1). Resident species included longnose suckers, whitefish, northern pike, Arctic grayling, and sheefish *leucichthys nelma*. Sheefish was the only species recovered as a carcass that was not observed passing upstream.

AGE, SEX, AND LENGTH COMPOSITION

Chinook Salmon

Sample size and distribution was adequate to estimate ASL composition of the annual escapement within the stated confidence intervals. Sampling was conducted periodically on an opportunistic basis from 29 June to 2 August, resulting in a total sample of 330 Chinook salmon. Of those, age was determined for 275 fish (83% of the total sample), or 13.3% of annual Chinook salmon escapement (Tables 2 and 3). The escapement was partitioned into 3 temporal strata based on sampling dates, with sample sizes of 174, 53, and 48 in the first, second, and third strata, respectively (Table 2).

Most Chinook salmon age *groups* were comprised of only one age *class*; i.e. all age-4, -5, and -6 fish were of the -1.2, -1.3, and -1.4 age classes, respectively (Table 2). Of the age-7 component, 71% were age-1.5 and 29% were age-2.4. The 2007 Chinook salmon escapement was dominated by 3 age classes that when combined comprised over 98% of the total annual escapement (Table 2; Figure 4). Age-1.3 was the most abundant age class (43.9%), followed by age-1.2 (34.7%) and age-1.4 (19.7%). Age-3 and age-7 fish comprised a minute fraction of escapement in 2007 (0.4% and 1.4%, respectively). No age-8 fish were identified in the sample. The proportion of age-1.2 fish decreased slightly as the run progressed while the proportion of age-1.3 fish increased slightly (Table 2; Figure 5). The proportion of age-1.4 varied slightly during the run but no consistent pattern was observed. Of the 3 dominant age classes (age-1.2, -1.3, and -1.4) age-1.3 fish remained the dominant age class (42.5% to 47.9%) throughout the run while age-1.4 remained the weakest (17.2% to 26.4%). The greatest intra-seasonal variation occurred among the age-1.2 fish; the contribution of the age-1.2 component ranged from a minimum of 25.0% to a maximum of 39.1%.

Based on ASL sampling, the ratio of males to females in the Chinook salmon escapement past the Tatlawiksuk River weir was approximately 3:1 (Table 2). Female Chinook salmon comprised 27.2% of the total annual escapement based on weighted ASL samples. The percentage of females increased continually from the first strata to the last, but never exceeded that of males (Figure 6). Older fish were largely female (72% of age-1.4), and younger fish were largely male (73% of age-1.3, and 99% of age-1.2).

Length samples for each age-sex class were generally few within each stratum (Table 3). Combined over the season, samples exhibited length partitioning by sex and age class (Figure 7). Female Chinook salmon were consistently larger at age than males, and generally average length increased with age for both females and males. Lengths ranged from 604 to 972 mm in females, and from 380 to 895 mm in males (Table 3). Mean lengths of female Chinook salmon were 687 mm at age-1.3, and 805 mm at age-1.4. Mean lengths of male age-1.2, -1.3, and -1.4 fish were 545, 664, and 742 mm, respectively.

Chum Salmon

The ASL sampling objective was achieved for chum salmon in 2007. Five pulse samples were collected between 29 June and 5 August, from a total of 1,026 fish. Of those, age was determined for 920 chum salmon (90% of the total sample), or 1.1% of annual chum salmon escapement (Tables 4 and 5). The chum run was partitioned into 5 temporal strata based on sampling dates, with sample sizes ranging between 180 and 196 per stratum.

The chum salmon escapement was largely represented by age-0.3 fish, which comprised 80.2% of annual escapement. Age-0.4 fish comprised 15.8% of escapement, followed by age-0.2 at 3.3% and age-0.5 at 0.6% (Table 6). Age composition changed little over the course of the run. The proportion of age-0.3 chum salmon ranged from a minimum of 72.4% early in the run to a maximum of 82.4% near the end while the proportion of age-0.4 individuals ranged from a maximum of 24.5% early in the run to a minimum of 11.5% near the end (Table 4; Figure 8).

Based on ASL sampling, the proportion of males and females in the chum salmon escapement past the Tatlawiksuk River weir was approximately equal (Table 4). Female chum salmon comprised 52.3% of the total annual escapement based on weighted ASL samples. The proportional contribution of females tended to increase over the course of the run from a minimum of 40.8% in the first stratum to a maximum of 64.3% in the last (Table 4; Figure 6).

Sample sizes were large enough to estimate mean length in the dominant age-sex classes (Table 5; Figure 7). Mean length was 561 mm at age-0.3, and 572 mm at age-0.4, among male chum salmon. For females, mean length was 537 mm at age-0.3, and 534 mm at age-0.4. Mean length at age was significantly greater for males than females. Mean length increased with age in males, but overlapped broadly between age-0.3 and -0.4 females. For both males and females, mean length at age tended to decrease slightly over the course of the run (Figure 9).

Coho Salmon

Annual sample size was sufficient to estimate the ASL composition of annual coho salmon escapement within the stated confidence intervals; however, the distribution of the pulse samples was not adequate in that the first third of the run was not sampled. High water conditions delayed collection efforts until 20 August. Between 20 August and 7 September 510 coho were sampled. Of those, age was determined for 419 fish. Recognizing that the early portion of the run was not represented in the sample, the coho run was partitioned into 4 temporal strata based on sampling dates. Strata consisted of 0, 139, 137, and 143 samples respectively (Tables 6 and 7). ASL composition was not estimated for the first stratum that represented the earliest 31% of escapement. Sample sizes in the remaining strata were adequate to estimate the ASL composition of each stratum.

Samples ranged from 86.9% to 94.4% age-2.1 fish (Table 6; Figure 10) with small portions of age-1.1 and -3.1 also present. Age-2.1 fish comprised 88.3% of the total weighted sample, followed by age-3.1 and -1.1 at 6.8% and 4.9% respectively (Table 6; Figure 4). Despite the imperfect sample distribution, these percentages were considered a reliable estimate of age composition for the annual escapement because age composition tends to be temporally stable at the Tatlawiksuk River weir (Figures 4 and 10) and throughout the Kuskokwim Area (Molyneaux et al. *In prep*).

The ratio of female coho salmon ranged from 52.4% to 58.4% over the sampled portion of the run (Figure 6). However, a total season sex ratio was not computed in 2007. In contrast to age composition, sex composition tends to vary during a single run (Molyneaux et al. *In prep*); for this reason, investigators refrained from estimating total season sex composition because the first third of the run was not reflected in the seasonal sample.

Mean length at age-2.1 increased from 527 to 554 mm for males and varied between 553 and 560 mm for females over the sampled portion of the run (Figure 11). When samples were weighted by abundance in their respective strata, mean length at age-2.1 for the total sample was 537 mm for males and 556 mm for female coho salmon (Figure 7). Mean length at age-2.1 was significantly less for male coho salmon than females in the sampled portion of the run. Similar to sex ratio, mean lengths at age were not estimated for annual escapement in 2007 because historical data indicate samples may vary considerably over the course of a season, for both male and female coho salmon at Tatlawiksuk River weir (Costello et al. 2007).

WEATHER AND STREAM OBSERVATIONS

Crew successfully collected twice daily weather and stream measurements between 15 June and 18 September, 2007 (Appendix D1). Water level ranged between 19 and 163 cm on the staff gauge, and averaged 55.6 cm over the operational period (Figure 12). Based on twice-daily thermometer readings, water temperature in the Tatlawiksuk River ranged from 3.0 to 16.0°C and averaged 10.8°C over the operational period (Figure 12). In addition, stream temperature was recoded hourly from 15 June through 17 September, 2007 using a Hobo® Water Temp Pro[5] data logger and summarized in Appendix D2. Hourly readings ranged from 6.6 to 16.2°C over the operational period, and daily stream temperature averaged 11.5°C.

KNA HIGH SCHOOL INTERNSHIP PROGRAM

Sixteen high school student from 7 local villages participated in the program in 2007, all of whom successfully completed their internships. Tatlawiksuk River weir hosted 5 students,

[5] Product names used in this report are included for scientific completeness, but do not constitute a product endorsement.

George River weir hosted 10 students, and the Kalskag fish wheels (the Run Reconstruction project) hosted 1 student. Transportation logistics largely governed where students were hosted.

RELATED FISHERIES PROJECTS

Kuskokwim River Chinook Salmon Run Reconstruction

A total of 5 radiotagged Chinook salmon were detected by the receiver station located near the Tatlawiksuk River weir in 2007. All of these eventually passed upstream of the receiver station and were considered recaptures and all were later detected upstream of the weir during aerial tracking surveys in July and August (K. L. Schaberg, Commercial Fisheries Biologist, ADF&G, Anchorage; personal communication).

Preliminary results estimated an inriver abundance of 121,370 Chinook salmon (SE = 13,027; 95% CI 95,837–146,904) greater than 450 mm METF length upstream of Kalskag in 2007. Based on this estimate, the Tatlawiksuk River stock represented 1.7% of total abundance upstream of Kalskag. Detailed results from the Run Reconstruction Project can be obtained from Schaberg (K. L. Schaberg, Commercial Fisheries Biologist, ADF&G, Anchorage; personal communication).

Kuskokwim River Sockeye Salmon Investigations

No radiotagged sockeye salmon were detected passing the Tatlawiksuk River weir and receiver station in 2007. Tagged sockeye salmon were tracked to tributaries throughout the Kuskokwim River basin using 18 ground-based tracking stations, and 3 aerial tracking surveys conducted in July, August, and September. Of 488 tags deployed, 398 (81%) successfully resumed upstream migration, and 378 (77%) were successfully tracked to tributary streams. Radiotagged sockeye salmon were identified in most major drainages between Kalskag and the Stony River drainage. Large aggregates were observed in the Aniak, Holitna, Hoholitna, and Stony River drainages. Four were observed in the Holokuk River. The highest concentrations were observed throughout the Holitna River. Complete results of this project can be obtained from Gilk and Molyneaux (*In prep*).

DISCUSSION

ESCAPEMENT MONITORING

Daily and total annual escapements were successfully determined for each of the objective species in 2007 (Table 1). Historical passage data from Tatlawiksuk River weir, along with daily passage counts from the 2007 season indicate the weir was operational for nearly the entire Chinook and chum salmon runs. Though an early portion of the coho run was missed between 6 and 11 August, successful operations during the remainder of the coho run provided for a reliable escapement estimate. The weir remained operational for a majority of the sockeye migration in 2007 as well.

Chinook Salmon

Abundance

Daily and total annual escapements of Chinook salmon reported at Tatlawiksuk River weir in 2007 are considered reliable determinations based on the minimal reliance on estimates of missed passage (1.6% of total annual escapement). The escapement of 2,061 Chinook salmon in 2007 was near the historical average at Tatlawiksuk River weir (Table 1; Figure 13), but was higher than those reported in 1999 and 2000 that contributed to the BOF classifying Kuskokwim River Chinook salmon as a stock of concern (Burkey et al. 2000a). A formal escapement goal has not yet been established for the Tatlawiksuk River, which precludes assessment of the adequacy of the 2007 escapement. However, escapement goals were met or exceeded in 2007 in tributaries where they have been established (ADF&G 2004; Molyneaux and Brannian 2006), and generally escapements have improved in recent years from below-average levels in 1998–2000 (Bergstrom and Whitmore 2004; Molyneaux and Brannian 2006).

Historical escapement data for the Tatlawiksuk River weir is not yet sufficient to apply the Bue and Hasbrouck method[6] for developing a sustainable escapement goal (SEG) range. A minimum 10 years of reliable escapement data (one life cycle of returns) are generally required (Molyneaux and Brannian 2006). Escapement data from 1998 and 2003 are lacking due to weir operational shortfalls. If successful weir operation continues, the 10 year minimum requirement for establishing an SEG will be achieved in 2009, and an SEG will likely be proposed to the Alaska Board of Fisheries in 2010. At the time of this report, paired weir and aerial survey data were available for only 1 year, but the simultaneous use of both enumeration methods in future years may provide a foundation on which to estimate escapement during a year when the weir was not successful but aerial surveys were conducted. This estimation method has been used in the past when data were lacking otherwise, and increase the likelihood that proposed escapement goals will be developed before 2010. Using escapement data collected through 2005, the SEG derived from the Bue and Hasbrouck method would range between 1,500 and 2,900, in which existing years of escapement data would be equally distributed above and below the median. This SEG range is considerably below the estimates for the number of spawners at maximum sustained yield (S_{msy}) and spawners at carrying capacity (S_c), 3,695 and 9,839 fish, derived using the habitat-based model developed by Parken et al. (2004) and described by Molyneaux and Brannian (2006). This suggested carrying capacity is slightly below that suggested for the Takotna River using the same method and existing data, though the Chinook salmon escapement at the Tatlawiksuk River weir is generally much greater. For both systems, carrying capacity based on the habitat-based models implies the potential for much higher escapements than currently observed.

The overall Kuskokwim River Chinook salmon escapement was considered above average in 2007 (Figure 13; J. C. Linderman Jr., ADF&G Division of Commercial Fisheries Biologist, Bethel; personal communication). The Kuskokwim River Chinook salmon escapement index was higher in 2007 than in all previous years except 2004–2006, which were the highest years on record (Figure 13). Although abundance trends vary from year to year among the 6 weir projects in the Kuskokwim River, general trends are similar, with escapements peaking in 2004 and 2005 from lows in 1999 and 2000.

Since the late 1980s, Chinook salmon have received little harvest pressure from the Kuskokwim River commercial fishery. Chinook salmon have not been targeted for commercial exploitation since 1987 and annual harvests since that time have been incidental to other species. In addition, a lack of commercial markets for chum salmon in recent years has depressed exvessel prices and reduced the number of permit holders actively fishing. The Alaska Board of Fish (BOF) discontinued its stock of concern designation of Kuskokwim River chum and Chinook salmon in

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[6] Unpublished report to the Alaska Board of Fisheries, November 2001 and February 2002, entitled *Escapement goal review of salmon stocks of Upper Cook Inlet*, by Brian G. Bue and J. J. Hasbrouck, located at Alaska Department of Fish and Game, Anchorage.

response to a favorable outlook for these stocks in 2007, but poor market interest resulted in no commercial openings during the June and July chum-directed fishery this year. The 2007 commercial harvest of 179 Chinook salmon was incidental to the August coho-directed fishery, and had negligible impact on individual Chinook stocks within the Kuskokwim River drainage (J. C. Linderman Jr., ADF&G Division of Commercial Fisheries Biologist, Bethel; personal communication).

The number of Chinook salmon harvested in the subsistence fishery is historically much greater than the commercial fishery. Estimates are not yet available for the 2007 subsistence harvests, but the 1997–2006 average harvest was 72,277 (Smith et al. *In prep*). Harvests have remained relatively stable since the late 1980s, making it likely that the subsistence harvests in 2007 was probably near this average. When compared with the preliminary abundance of 121,370 Chinook salmon greater than 450mm METF length (SE = 13,027; 95% CI) estimated to have migrated past Kalskag in 2007 (K. L. Schaberg, ADF&G Division of Commercial Fisheries Biologist, Anchorage; personal communication), the number harvested for subsistence use is significant and represents a much larger fraction of total run abundance than the commercial harvest. Based on a concern that subsistence fishers were concentrating their efforts towards the beginning of the Chinook salmon run through the lower river and unknowingly targeting some stocks, ADF&G began implementing a subsistence fishing schedule in 2001. It was designed to distribute subsistence fishing effort more evenly throughout the run but was discontinued in 2007 because evidence suggested it was not producing the desired result and had little effect on the timing of subsistence harvest efforts (T. Hamazaki, ADF&G Division of Commercial Fisheries Biometrician, Anchorage; personal communication).

Run Timing at Weir

Based on median passage dates, the timing of the Chinook salmon run at Tatlawiksuk River weir in 2007 (9 July) was later than most previous years (Figure 3; Appendix B1). The run was also more compacted in 2007 than in previous years, based on passage of the central 50% of the run. Later and more compacted than average run timing was similarly observed at most other ground-based escapement monitoring projects in the Kuskokwim River in 2007 (Costello et al. 2008; Miller and Harper 2008; Plumb and Harper 2008; Thalhauser et al. *In prep*; Williams et al. *In prep*).

Chum Salmon

Abundance

Daily and total annual escapements of chum salmon reported at Tatlawiksuk River weir in 2007 are considered reliable determinations based on the minimal reliance on estimates of missed passage (4.6% of total annual escapement). The reported escapement of 83,246 chum salmon at Tatlawiksuk River weir in 2007 is much higher than in previous years, which ranged from 7,044 fish in 2000 to 55,720 fish in 2005 (Figure 14). A formal escapement goal for chum salmon at Tatlawiksuk River weir has not yet been established, which precludes assessment of the adequacy of the 2007 escapement. However, escapement goals were met or exceeded elsewhere in the Kuskokwim River drainage in 2007.

Similar to Tatlawiksuk River weir escapements, overall chum salmon escapements to Kuskokwim River tributaries have recovered from below-average levels in 1999 and 2000 to record high levels in more recent years (Figure 14). These record high escapements are partly a function of historically low commercial harvest pressure on chum salmon in the Kuskokwim. Prior to the poor chum runs in 1999 and 2000, the 10-year average commercial harvest was 334,029 chum salmon. Closure of the chum directed commercial fishery in 2001–2003 helped restore runs to healthy levels but poor market demand for Kuskokwim river chum since the fishery was re-opened in 2004 has resulted in little harvest activity. The Alaska Board of Fish (BOF) discontinued its stock of concern designation of Kuskokwim River chum and Chinook salmon in response to a favorable outlook for these stocks in 2007, but poor market interest resulted in no commercial openings during the June and July chum-directed fishery. The 2007 commercial harvest of 10,763 chum salmon was incidental to the August coho-directed fishery, and probably had negligible impact on individual chum stocks within the Kuskokwim River drainage (J. C. Linderman Jr., ADF&G Division of Commercial Fisheries Biologist, Bethel; personal communication).

As with the commercial fishery, the effect of the subsistence fishery on individual Kuskokwim River chum salmon stocks was probably not significant. In recent years, chum salmon have generally not been targeted for subsistence use, and the numbers annually harvested since the early 1990s have generally been far less than annual harvests in the 1960s–1980s. In fact, annual subsistence harvests of Chinook salmon have generally exceeded chum salmon harvests since 1993, despite their lower abundance (J. C. Linderman Jr., ADF&G Division of Commercial Fisheries Biologist, Bethel; personal communication). Subsistence harvest estimates are not yet available for 2007, but the 1997–2006 average harvest was 52,439 fish (Smith et al. *In prep*). The 10-year average is a viable approximation of the 2007 subsistence harvest because these harvests have not varied greatly in recent years. With the overall Kuskokwim River chum escapement probably being much larger than the 1,000,000 fish counted in the 7 monitored streams alone, a subsistence harvest of just over 50,000 chum salmon probably had no significant impact to individual stocks in 2007.

Recognizing the implications of the BOF stock of concern designation in 2000, ADF&G implemented a subsistence fishing schedule in 2001 that was intended to distribute subsistence fishing effort more evenly throughout the Kuskokwim River chum salmon run. The subsistence fishing schedule was implemented based on a concern that subsistence fishers were concentrating their efforts towards the beginning of the chum salmon run through the lower river and unknowingly targeting some stocks. While it was being practiced, the subsistence fishing schedule was studied for its effectiveness. After 7 years of implementation, there was evidence that the fishing schedule was not producing the desired result and had little effect on the timing of subsistence harvest efforts (T. Hamazaki, ADF&G Division of Commercial Fisheries Biometrician, Anchorage; personal communication). The subsistence fishing schedule was not continued in 2007, and likely had little effect on escapements to Tatlawiksuk River.

Historical escapement data at Tatlawiksuk River weir is not yet sufficient to apply the Bue and Hasbrouck method for an SEG range. A minimum 10 years of escapement data (one life cycle of returns) are generally required (Molyneaux and Brannian 2006). If successful weir operation continues, the 10 year minimum requirement for establishing an SEG will be achieved in 2009, and an SEG will likely be proposed to the Alaska Board of Fisheries in 2010. Using escapement data collected through 2005, the SEG derived from the Bue and Hasbrouck method would range between 9,000 and 33,000 fish. The annual variation observed in Tatlawiksuk River chum salmon escapements may result in changes to this suggested SEG after more years of escapement data are collected.

Run Timing at Weir

Based on median passage dates, the timing of the chum salmon run at Tatlawiksuk River weir in 2007 (16 July) was later than most previous years (Figure 3; Appendix B2). Median passage dates have ranged from 10 July in 2002 to 18 July in 1999. Median passage dates at other Kuskokwim River chum escapement projects in 2007 were all later than most previous years as well (Costello et al. 2008; McEwen *In prep*; Miller and Harper 2008; Plumb and Harper 2008; Thalhauser et al. *In prep*; Williams et al. *In prep*).

Coho Salmon

Abundance

Daily and total annual escapements of coho salmon reported at Tatlawiksuk River weir in 2007 are considered reliable determinations. Estimates for missed coho passage constituted 16.9% of the total annual escapement reported (Table 1). These estimates were necessitated primarily by the inoperable period between 6 and 11 August when water levels exceeded the operational limit for the weir. Peak daily coho passage occurred on 21 August, well after the inoperable period (Table 1). This indicates the bulk of the run passed while the weir was fully operational after 11 August. This is supported additionally by historical run timing information from Tatlawiksuk river weir (Figure 3; Appendix B3). In addition, passage trends indicate daily abundance was building steadily before and after the inoperable period, which supported the "linear method" used for estimating the passage missed.

The annual escapement of 9,453 coho salmon in 2007 was intermediate to previous years at Tatlawiksuk River weir, which ranged between 3,455 in 1999 and 16,410 in 2004 (Figure 15). No formal escapement goals have been established for the Tatlawiksuk River, which precludes assessment of the adequacy of the escapement. Kogrukluk River weir is the only project in the Kuskokwim drainage which has an escapement goal for coho salmon associated with it (Figure 15). The escapement goal was achieved in 2007 for coho, but abundances throughout the drainage appeared mixed. Relative to previous years at other projects, coho escapements were week at both Kwethluk and Tuluksak River weirs, strong at George River weir, and near average at Kogrukluk, Tatlawiksuk, and Takotna River weirs (Costello et al. 2008; Miller and Harper 2008; Plumb and Harper 2008; Thalhauser et al. *In prep*; Williams et al. *In prep*).

Escapement goals have not yet been established for Tatlawiksuk River coho salmon due to a recognized lack of historical escapement data. Reliable escapement estimates have been determined in 6 of 9 years the project has been operated for coho salmon, with flood conditions precluding estimates for the remaining 3 years. The Bue and Hasbrouck method for developing an SEG range generally require a minimum of 10 years with reliable escapement estimates (Molyneaux and Brannian 2006). An SEG might be established for Tatlawiksuk River coho salmon as early as 2012, but this is unlikely given the challenging stream conditions typical during the coho salmon run.

Commercial harvest pressure on Kuskokwim River coho salmon has always been considerable. The commercial harvest of 141,049 coho salmon in 2007 (J. C. Linderman Jr., ADF&G Division of Commercial Fisheries Biologist, Bethel; personal communication) was probably sufficient to noticeably detract from observed escapements at tributary weirs, considering escapements at the 6 Kuskokwim River weir projects totaled about 90,000 coho. Total inriver abundance estimates are not available for 2007, but estimates from 2001–2005 averaged 688,885 fish upstream of

Kalskag (Pawluk et al. 2006), which represent the majority of Kuskokwim River coho stocks. A commercial fishery for coho salmon has been permitted annually in the Kuskokwim River since statehood, but the numbers harvested in recent years have generally remained below those of the 1980s and most of the 1990s (Smith et al. *In prep*). The small harvests in recent years may be partially attributable to relatively low permit utilization resulting from the depressed commercial markets for chum salmon. Since Kuskokwim River coho salmon have not been identified as a stock of concern by the Alaska BOF (Bergstrom and Whitmore 2004), they have not been the focus of conservation measures.

Contrary to the commercial fishery, the effect of the subsistence fishery on individual Kuskokwim River coho salmon stocks was probably not significant. Subsistence harvest estimates are not yet available for 2007, but the 1997–2006 average harvest was 30,427 fish (Smith et al. *In prep*). Records of coho salmon subsistence harvests have been kept since 1989 and during this time annual subsistence harvests have varied little. Thus, the recent 10 year average reasonably approximates the total harvest in 2007. Compared to the number of coho salmon captured in the commercial fishery and recognizing that escapement at most projects was near average, a subsistence harvest near 30,000 coho salmon probably did not significantly affect escapements of individual stocks.

Run Timing at Weir

Based on the median passage date, the timing of the coho salmon run at Tatlawiksuk River weir in 2007 (18 August) was earlier than all previous years determined (Figure 3; Appendix B3). Median passage dates in previous years ranged from 19 August in 2004 to 2 September in 1999. Median passage dates at other Kuskokwim River coho escapement projects in 2007 were all earlier than most previous years (Costello et al. 2008; Miller and Harper 2008; Plumb and Harper 2008; Thalhauser et al. *In prep*; Williams et al. *In prep*). The central 50% of the run occurred over a 14 day period in 2007, which equaled the historical average at Tatlawiksuk River weir.

Other Species

Sockeye Salmon

Few sockeye salmon are observed in the Tatlawiksuk River, and the reported escapement of 27 sockeye salmon in 2007 was typical for this species. Annual sockeye salmon escapements at the Tatlawiksuk River weir have ranged from 0 fish in 2000 to 77 fish in 2005 (Stewart et al. 2006). Sockeye salmon are not generally abundant in the Kuskokwim River, and sockeye salmon are not prominent in subsistence and commercial harvests. Comparatively little is known about sockeye salmon in the Kuskokwim River. As a result, escapement goals do not exist, and sockeye have not been considered a stock of concern by the BOF.

Historical run timing comparisons are limited by low abundances, but higher abundances in the last 3 years indicate spawning migration occurs primarily between late July and mid August (Stewart et al. 2006). Similar run timing has been observed at George and Takotna weirs (Costello et al. 2008; Thalhauser et al. *In prep*). However, run timing is considerably earlier at Kwethluk and Kogrukluk River weirs, which monitor more sizable sockeye escapements. Sockeye migrations generally peak in early July at Kwethluk and mid July at Kogrukluk River weirs (Miller and Harper 2008; Williams et al. *In prep*).

Pink Salmon

Pink salmon are occasionally observed in the Tatlawiksuk River, but only in small numbers. A total of 7 pink salmon were observed in the Tatlawiksuk River in 2007, where counts of have historically ranged from 0 to 20 fish. The Tatlawiksuk River is not a primary spawning tributary for pink salmon; therefore, it is not surprising that few pink salmon were observed in 2007 relative to other tributaries such as the Kogrukluk River (Williams et al. *In prep*).

Resident Species

Longnose suckers are historically the most abundant resident species counted at the Tatlawiksuk River weir. Passage counts of longnose suckers are not meant to represent actual abundance because smaller individuals are able to pass through the pickets freely, and migration timing typically precedes weir installation (Stewart et al. 2006). Counts are recorded to serve as a broad index for monitoring resident populations and species that occur at Tatlawiksuk River.

Upstream passage of longnose suckers in 2007 was observed mostly during July (Appendix A1). This was later than has been observed in previous years. Since the first full season of resistance board weir operation began in 2000, Sucker counts have ranged from 75 fish in 2004 to 2,905 fish in 2002. The count of 1,241 suckers in 2007 is close to the historical average of 1,210 fish. Similar to previous years, small numbers of whitefish, Northern pike, and Arctic Grayling passed upstream sporadically throughout the season (Appendix A1).

Carcasses

Carcasses counts do not provide a complete census of carcass load at Tatlawiksuk River weir. The installation of downstream passage chutes in late summer, to accommodate resident species, provides a pathway for postspawners and carcasses to pass uncounted. Daily carcass counts may noticeably decrease following their installation (Appendix C1). Second, the weir was removed long before coho salmon had completed spawning, so a reasonable estimate of coho salmon carcass load at the weir cannot be determined. Despite these confounding factors, it is believed a majority of Chinook and chum carcasses passing downstream of the weir are counted. The proportion of Chinook and chum escapements counted as carcasses at the weir in 2007 was 1.8% and 2.1% respectively. These small proportions indicate most of the carcasses were retained within the Tatlawiksuk River drainage throughout the season, thereby contributing to the productivity of the system through the addition of marine derived nutrients as described by Cederholm et al. (1999; 2000).

The use of carcass counts in analyses to estimate stream life in the Tatlawiksuk River has been discounted by Linderman et al. (2003), and is no longer considered. Additionally, weir carcass counts are generally biased low for females (DuBois and Molyneaux 2000), and are not employed to estimate sex composition of escapements.

AGE, SEX, AND LENGTH COMPOSITION

Chinook Salmon

The 275 aged samples (13% of escapement) were well distributed throughout the run and were adequate to estimate the ASL composition of total annual escapement in 2007 (Tables 2 and 3). ASL composition has been estimated in 5 of 10 years the project has operated. Flood damage precluded estimations of escapement in 1998 and 2003. Small sample sizes precluded estimates of ASL composition in 1999, 2000, and 2001.

Age Composition

The predominance of age-1.2, -1.3, and -1.4 classes in 2007 is similar to past years at Tatlawiksuk River, and similar to what has been observed elsewhere in the Kuskokwim Area (Molyneaux et al. *In prep*). Relative to previous years, abundance in 2007 was high for age-1.2, intermediate for age-1.3, and low for age-1.4 fish (Figure 4). Similar age distribution was evident at most other escapement monitoring projects in the Kuskokwim River drainage, indicating this was a widespread occurrence (Costello et al. 2008; Miller and Harper 2008; Plumb and Harper 2008; Thalhauser et al. *In prep*; Williams et al. *In prep*). The high abundance of age-1.2 fish suggests a relatively strong return in 2008 of the age-1.3 siblings (Molyneaux et al. *In prep*). The low abundance of age-1.4 fish may reflect the relatively weak return on age-1.3 fish in 2006. Appendix E1 provides a brood table for the available Tatlawiksuk River data, but the information is not yet complete enough to assess sibling relationships and cohort strength. Additionally, these data does not account for the fraction of Tatlawiksuk River fish taken in the harvest that occurs downstream of the weir.

Although sample sizes are generally too small at the Tatlawiksuk River weir to depict significant variations in age composition over the Chinook salmon run, compiling these data with past years may indicate trends that might otherwise be ignored (Figure 5). Patterns are unclear for age-1.3 and -1.4 fish, but age-1.2 fish appear to migrate earlier in proportion to the other age classes.

Sex Composition

Both the abundance and percentage of female Chinook salmon in the 2007 escapement was the lowest of 5 years determined at Tatlawiksuk River weir (Figure 16). Of the 3 dominant age classes, females composed about 1% of age-1.2 fish, 27% of age-1.3 fish, and 72% of age-1.4 fish in 2007 (Table 2). This age-sex composition is similar to previous years at the Tatlawiksuk River weir, and is typical of Chinook salmon throughout the Kuskokwim River drainage (Molyneaux et al. *In prep*). Therefore, both the low abundance and ratio of females can be attributed to the poor return of age-1.4 fish in 2007.

Although sample sizes may sometimes be too small at Tatlawiksuk River weir to depict significant variations in sex composition over the Chinook salmon run, compiling these data with past years may indicate trends that might otherwise be ignored. Historical data reveals a consistent pattern in the percentage of female Chinook salmon increasing over the run at the Tatlawiksuk River weir (Figure 6). The significance of the apparent increase is unknown and may be investigated in future years.

Length Composition

Mean lengths for each age-sex category in 2007 were generally below previous years with the exception of age-1.4 females, which was similar to previous years (Figure 17). Mean length increased with age, and females tended to be longer than males of the same age (Figure 7), which is a pattern commonly observed in Chinook salmon throughout the Kuskokwim River drainage (Molyneaux et al. *In prep*).

Although sample sizes are generally too small at the Tatlawiksuk River weir to depict significant variations in length composition over the Chinook salmon run, compiling these data with past years may indicate trends that might otherwise be ignored. Figure 18 suggests no apparent intra-annual trend in length at age for either sex. Kuskokwim Area Chinook salmon rarely show an obvious intra-seasonal trend in lengths by age-sex class over the course of the season, and apparent trends tend to be weak and their significance is unknown (Molyneaux et al. *In prep*).

Management Implications

Salmon are harvested in both subsistence and commercial fisheries that occur in the main stem Kuskokwim River far downstream from Tatlawiksuk River and other spawning areas (Whitmore et al. 2008). Most harvest is taken with gillnets that are size selective for discreet components of the returning salmon population. The potential impact of the size selective harvest is perhaps most consequential to Chinook salmon because of their wide range of size at maturity.

Subsistence fishers tend to favor using gillnets hung with large mesh web (e.g., 8 in stretch mesh; Smith et al. *In prep*), so their harvest is selective for the larger and older Chinook salmon. This is the same segment of the population where females are most common. Timing of the subsistence harvest tends to be weighted towards the early part of the run, which is when stocks with more distant spawning grounds such as Tatlawiksuk River are likely to be the most concentrated, although the degree of overlap in stock-specific run timings tends to be broad for Chinook salmon (Pawluk et al. 2006; Schaberg et al. *In prep*). The exploitation rate of the subsistence fishery was estimated to range between 22 and 32 percent of the total Kuskokwim River Chinook salmon runs in the years 2002, 2003, 2004, and 2005 (Molyneaux and Brannian 2006).

In contract, commercial fishers are limited to using 6 in or smaller mesh sizes (Whitmore et al. 2008), so their harvest is selective for smaller Chinook salmon in a size range dominated more by males. The timing of the commercial fishery tends to be more towards the second half of the Chinook salmon run; however, in recent years the low market interest has resulted in very limited commercial harvest. Exploitation rate from the commercial fishery are estimated to have been no more than 1.6 % in the 2002 to 2005 run reconstructions (Molyneaux and Brannian 2006).

The Chinook salmon seen at Tatlawiksuk River weir and spawning grounds elsewhere in the Kuskokwim River consist of the fraction of fish that escape harvest. The selectivity of that harvest influences the resulting age, sex, and length composition in the escapement (Figure 19). Nearly all the Chinook salmon harvest in 2007 occurred in the subsistence fishery. The size selection of the prevalent subsistence harvest practices, in concert with the relatively high exploitation rate of the subsistence fishery, increased both the prevalence of smaller male Chinook salmon, and the scarcity of larger fish and females in the escapement. This likely amplified the high proportion of young male to older female Chinook salmon observed at Tatlawiksuk River weir and elsewhere in the Kuskokwim River drainage.

Chum Salmon

Sampling goals were achieved for chum salmon in 2007, and data were adequate to describe both total annual composition and intra-annual variations. ASL composition has been estimated in 8 of 10 years the project has operated. Flood damage precluded estimations in 1998 and 2003.

Age Composition

Chum salmon return to the Kuskokwim Area at age-0.2, -0.3, -0.4, -0.5, with age-0.3 and -0.4 predominant (Molyneaux et al. *In prep*). Similar age distribution has been observed historically in chum salmon escapements to the Tatlawiksuk River. The record escapement at Tatlawiksuk

River weir in 2007 was dominated by age-0.3 fish (80%), though abundance was high among all age classes (Figure 4). Similar age distribution was observed at Kwethluk and George Rivers, which also reported record high escapements in 2007 (Miller and Harper 2008; Thalhauser et al. *In prep*). Age-0.3 fish were less prevalent in other portions of the Kuskokwim River drainage (Costello et al. 2008; Plumb and Harper 2008; Williams et al. *In prep*). The large showing of age-0.5 fish relative to previous years at Tatlawiksuk River weir was indicative of the 2001 cohort which has produced high returns in recent years. However, sibling relationships among chum salmon are generally not this strong in the Kuskokwim Area (Molyneaux et al. *In prep*), and the abundance of -0.3 fish in 2007 may not necessarily indicate a comparable return in 2008.

Changes in age composition over the chum salmon run are likely subtle and may not appear significant in any given year. However, pooling age data with past years may indicate trends that might otherwise be ignored. Figure 8 shows a tendency in the proportion of age-0.4 fish to decrease over the run, and a tendency in the proportion age-0.2 fish to increase toward the end of the run at Tatlawiksuk River weir. These trends were likely disguised in 2007 by the abundance of age-0.3 fish, resulting in smaller sample sizes of age-0.2 and -0.4 fish relative to previous years. The pattern of age becoming younger over the run appears to be common for chum salmon populations in the Kuskokwim Area and elsewhere (Molyneaux et al. *In prep*).

Sex Composition

At 52%, the percentage of female fish in the 2007 chum salmon escapement was similar to previous years at the Tatlawiksuk River weir, which has ranged from 39% to 58% and averaged 49% annually (Figure 16). Annual chum salmon escapements in the Kuskokwim Area tend to exhibit a one to one sex ratio (Molyneaux et al. *In prep*).

The increase in the ratio of females over the run is similar to previous years at Tatlawiksuk River weir (Figure 6). This increase was expected as male chum salmon typically migrate earlier to the spawning grounds than females in the Kuskokwim Area (Molyneaux et al. *In prep*).

Length Composition

Mean length at age was less in 2007 than in most previous years at Tatlawiksuk River weir for both male and female chum salmon (Figure 20). Results from other Kuskokwim River escapement projects indicate this was a widespread occurrence in 2007 (Costello et al. 2008; Miller and Harper 2008; McEwen *In prep*; Plumb and Harper 2008; Thalhauser et al. *In prep*; Williams et al. *In prep*).

The mean length of fish in each age-sex category tended to decrease as the 2007 season progressed (Figure 9), which is typical for chum salmon at Tatlawiksuk River weir and elsewhere in the Kuskokwim River drainage (Molyneaux et al. *In prep*). The disparity in mean length at age between male and female fish in 2007 is similar to previous years at Tatlawiksuk River weir (Figures 7 and 20), and is typical of chum salmon stocks in the Kuskokwim Area (Molyneaux et al. *In prep*).

Coho Salmon

The distribution of the coho salmon sampling effort was technically not sufficient to estimate total season ASL composition because high water conditions prohibited the collection of ASL data from the first third of the run. However, age composition of coho salmon tends to vary little through the run and the 2007 sample collection was considered adequate to estimate total season age composition. In contrast, the existing samples were considered inadequate for estimating total seasonal sex and length composition because these measures tend to exhibit considerable intra-annual variation.

Age Composition

Coho salmon return to the Tatlawiksuk River at age-1.1, -2.1, and -3.1, but most predominantly at age-2.1 (Figure 4). Similar age composition occurs throughout the Kuskokwim Area (Molyneaux et al. *In prep*). At 88.3% of escapement, the proportion of age-2.1 fish in 2007 was similar to previous years at Tatlawiksuk River weir, which ranged from 79.1% in 1999 to 94.4% in 2004, and averaged 88.7%. Other Kuskokwim River escapement projects reported age composition of coho salmon escapements in 2007 between 86.1% age-2.1 at Tuluksak River weir, and 94.9% age-2.1 at George River weir (Costello et al. 2008; Miller and Harper 2008; McEwen *In prep*; Plumb and Harper 2008; Thalhauser et al. *In prep*; Williams et al. *In prep*).

Sex Composition

The female ratios of 53%, 58% and 52% sampled in 2007 were within the historical range during the middle and late portions of the run (Figure 6). Applied to annual escapement, the total sample would likely overestimate the proportion of female coho salmon in 2007 because historical data indicate that the incidence of females tends to increase over the run at Tatlawiksuk River weir (Figure 6). The annual sex ratio in previous years' escapements has ranged from 39% to 52% female coho salmon (Figure 16). Based on comparison with previous years, the annual sex ratio in 2007 was likely close to the historical average of 47%. Among other Kuskokwim River escapement projects the ratio of female coho salmon varied considerably, ranging from a below average 36% at Tuluksak River weir to a record high 52% at Takotna River weir (Costello et al. 2008; Miller and Harper 2008; Plumb and Harper 2008; Thalhauser et al. *In prep*; Williams et al. *In prep*).

Length Composition

Because coho are predominately age-2.1 fish, length samples for other age classes are generally too few for consideration. With respect to the middle and late portions of the run, males were shorter in 2007 than in previous years, and females were within their historical range (Figure 11). In the total weighted sample mean length at age-2.1 was significantly greater for female coho salmon than for males (Figure 7). Similar results were reported at George and Takotna River weirs in 2007 as well (Costello et al. 2008; Thalhauser et al. *In prep*). Though not significant in previous years at Tatlawiksuk River weir, Molyneaux et al. (*In prep*) indicate a tendency for length at age to be greater for female coho salmon than for males.

WEATHER AND STREAM OBSERVATIONS

Record low water was observed during the early portion of the 2007 season, and levels remaining below average throughout most of the Chinook and chum salmon runs (Figure 12). Water temperatures were generally near or below average throughout the season (Figure 12).

The relationship between water level/temperature and passage strength or timing has been investigated in past years at Tatlawiksuk River weir with little success. Any correlations were not easily discernible from the available data because daily salmon passage was likely influenced by the timing and duration of counting sessions, the level of ASL sampling activity, and weir cleaning and repair efforts. This analysis was not continued in 2007.

The 2 methods for determining morning water temperature at the Tatlawiksuk River weir yielded similar results in 2007 (Figure 21). Daily morning water temperatures derived from both methods paralleled each other for most of the season, but the daily morning water temperature determined from thermometer measurements was about 1° to 2° C cooler, on average, than the reading recorded by the Hobo® Water Temp Pro data logger around the same time. This was probably the result of taking temperature readings along the stream margin where colder water was seeping through the gravel beneath the bank. The data logger was likely more accurate as it was tethered to the stream bottom near mid channel. Use of the data logger to generate summaries of daily minimum, maximum and average stream temperatures should be continued in future years to build a more comprehensive historical data set.

Knowledge of environmental conditions and a commitment to long-term monitoring may be valuable in understanding migration and survival. Quinn (2005) notes that migration in salmon is probably controlled by genetic factors as an adaptation to long-term average environmental conditions. Keefer et al. (2004) found a positive correlation between river discharge and run timing of Columbia River Chinook salmon stocks, and that Columbia River sockeye salmon have started their inriver migration 2 weeks earlier in response to warmer water conditions resulting from dam construction. We cannot begin to assess the affects of changing environmental conditions on Kuskokwim River salmon without the relatively complete weather and stream observations collected by weir crews such as at the Tatlawiksuk River. Escapement projects must continue to be diligent in the collection of weather and stream data. Perhaps with sufficient data researchers and managers will be able to assess relationships between migration and environmental factors relevant in the broader spatial-temporal context.

KNA High School Internship Program

Since 1998 KNA has provided 144 internships to local area high school students at fisheries projects operated cooperatively with ADF&G. A number of students have subsequently been employed by KNA and ADF&G as technicians at these same projects (Hildebrand and Orabutt 2007). These internships benefit both students and the projects that host them. Interns gain exposure to fisheries monitoring projects and the employment opportunities associated with them. The projects gain a much needed level of community involvement, which the authors believe contributes to continued local support of the research and management structure that they support.

Related Fisheries Projects

Kuskokwim River Chinook Salmon Run Reconstruction

Tag deployment efforts were successful in 2007. The Chinook salmon abundance estimates generated as one component of the project mark the sixth year that an abundance estimate was determined for the Kuskokwim River drainage upstream of the Aniak River confluence, and the second year that an abundance estimate could be calculated that includes the Aniak River. The deployment of anchor tags in addition to radio tags provided a tag sample large enough to investigate travel speed and run timing, thereby providing an additional year for historical comparisons of these measures.

At the time of publication, development of the model required for a comprehensive run reconstruction was still ongoing. Until the model is completed, historical abundance estimates cannot be computed. Results and discussion of success will be reported in a separate publication that will be written upon completion of historical run abundance estimates.

Abundance Estimate

Project investigators in 2007 worked closely with investigators from the former *Inriver Abundance of Chinook Salmon in the Kuskokwim River* project to ensure consistency in methodology so that abundance estimates remain comparable. Generally, the same limitations and assumptions of the former project persist in the current. For example, Chinook salmon smaller than 450 mm METF were not radiotagged, so abundance estimates generated then and now do not include the fraction of the Kuskokwim River Chinook salmon run below this threshold. Annual abundance estimates generated without this component likely do not greatly underestimate the total abundance inclusive of fish less than 450 mm METF because such small Chinook salmon are uncommon in the Kuskokwim River. At Tatlawiksuk River weir, for example, these small Chinook salmon comprised less than 1% of escapement in 2007.

Run Timing

The run timing information derived from pooling the radio-tag and anchor-tag samples from *Kuskokwim River Chinook Salmon Run Reconstruction* indicates slight variation in stock-specific run timing in 2007. In 2007, as in most past years, there was a noticeable inverse relationship between natal stream distance and time of passage past the Kalskag tagging sites (Figure 22). Based on median passage dates, stocks with the furthest to travel tended to arrive earlier than stocks bound for tributaries nearer the tagging sites. The earliest arriving stocks were Takotna and Tatlawiksuk; both had a median passage date (at the Kalskag tagging sites) of 24 June. Consistent with this pattern, George River and Salmon River fish tended to arrive later (29 and 30 June, respectively), but, contrary to this pattern fish bound for the Kogrukluk River occurred after that for the Tatlawiksuk stock (28 June) despite it being further from the tagging sites. Though sample sizes are small, the median passage dates for tagged Tatlawiksuk River bound Chinook salmon past the tagging sites have been the earliest of any stock in 3 of the 5 years with comparable data. In the remaining years only the Takotna River stock arrived earlier.

Kuskokwim River Sockeye Salmon Investigations

No tagged sockeye salmon were observed at the Tatlawiksuk River weir in 2007, which precludes assessment of travel speed and run timing. This was not unexpected, however, because sockeye salmon escapement past the Tatlawiksuk River weir was not significant in 2007 and observed escapement was probably not stock from the Tatlawiksuk River. In the 5 years that mark–recapture has been conducted for sockeye salmon, tagged sockeye only reached the Tatlawiksuk River weir in 2004 and 2005. The numbers of tags recaptured during these years were too few to formulate any conclusions about these fish (N = 2 in 2004 and N = 3 in 2005), plus the sockeye salmon observed in the Tatlawiksuk River are not thought to be a unique stock but individuals of stocks from other locations, possibly from the nearby Stony River which is known to be a large sockeye salmon producer.

CONCLUSIONS

CHINOOK SALMON

- The escapement of 2,061 Chinook salmon in 2007 was near the historical average at Tatlawiksuk River weir.
- The run was later in 2007 than most previous years.
- The high abundance of age-1.2 fish in 2007 suggests a relatively strong return of age-1.3 siblings in 2008.
- The poor return of age-1.4 fish resulted in low female abundance in 2007.
- Mean lengths for each age-sex category of Chinook salmon in 2007 were generally below those of previous years, with the exception of age-1.4 females, which was similar to previous years.

CHUM SALMON

- The escapement of 83,246 chum salmon in 2007 was much higher than any previous year at Tatlawiksuk River weir.
- The run was later in 2007 than most previous years.
- The record high escapement at Tatlawiksuk River weir in 2007 was dominated by age-0.3 fish.
- Mean lengths were generally shorter in 2007 than in most previous years at Tatlawiksuk River and throughout the Kuskokwim River drainage.

COHO SALMON

- The escapement of 9,453 coho salmon in 2007 was near the average of years determined at Tatlawiksuk River weir.
- The run was earlier in 2007 than all previous years determined.
- Considering the late temporal distribution of ASL samples in 2007, the age composition.
- The late sampling effort in 2007 was adequate to estimate age composition, but not the sex ratio or mean lengths of the annual escapement.

WEATHER AND STREAM OBSERVATIONS

- Water levels remained below average throughout most of the Chinook and chum salmon escapements.
- Water temperatures were generally near or below average throughout the season.

ACKNOWLEDGMENTS

The Tatlawiksuk River weir project is operated cooperatively by KNA and ADF&G, Division of Commercial Fisheries. The USFWS, Office of Subsistence Management, provided $154,666 in 2007 for this project through the Fisheries Resource Monitoring Program (FRMP), under agreement numbers 701817J647 and 701817C298, with matching support from the State of Alaska and KNA. Additionally, FRMP helps fund salmon age, sex, and length data analysis for this and many other projects in the Kuskokwim Area under agreement number 701817J646, and provides a KNA biologist position through its Partners Program in support of this and other projects under agreement number 701812J479. Operational funds have been provided to KNA from a number of sources including grants from the National Fish and Wildlife Foundation, and grants from the U.S. Bureau of Indian Affairs administered by the Bering Sea Fishermen's Association (BSFA). Coastal Villages Regional Fund provided moneys in 2006 and 2007 in response to recent budget cuts in the BSFA program. The Tatlawiksuk River weir was initiated under a grant from the Western Alaska Disaster Relief Program under the National Oceanic and Atmospheric Administration. Other groups such as the Kuskokwim Corporation and the ADF&G Division of Sport Fish have provided in-kind support to the project in the form of free land use for camp facilities, weir fabrication, and welding services. General Fund support from ADF&G included assistance from staff biologists, fish and wildlife technicians who serve as crew leaders or crew members, and some operational costs.

Many individuals contributed to the operation of the Tatlawiksuk River weir in 2007. Thanks to Amanda Latham of ADF&G, and Samantha John, David Orabutt, Derek Rader, Tamara Sakar, Jonathan Samuelson, and Calvin Simeon of KNA, for administrative and logistical support. Thanks also to KNA crew members Jesse Derendy and Harry George, KNA college interns Amanda Goods and Glenn Lindsey, and high school interns Robert Gusty, Bruce Morgan, Michelle Bobbie, Jeff Hunter, and Mark VanFleteren for contributing to the successful project in 2007. We especially thank the Gregory family of Sinka's Landing for providing winter storage facilities and many hours of Alaskan hospitality.

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TABLES AND FIGURES

Table 1.–Daily, cumulative, and cumulative percent passage of Chinook, chum, and coho salmon at the Tatlawiksuk River weir, 2007.

	Chinook Salmon			Chum Salmon			Sockeye Salmon			Coho Salmon		
Date	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage
14-Jun [a]	0			0			0			0		
15-Jun	0	0	0	0	0	0	0	0	0	0	0	0
16-Jun	0	0	0	0	0	0	0	0	0	0	0	0
17-Jun	0	0	0	0	0	0	0	0	0	0	0	0
18-Jun	0	0	0	0	0	0	0	0	0	0	0	0
19-Jun	0	0	0	0	0	0	0	0	0	0	0	0
20-Jun	0	0	0	2	2	0	0	0	0	0	0	0
21-Jun	0	0	0	3	5	0	0	0	0	0	0	0
22-Jun	0	0	0	0	5	0	0	0	0	0	0	0
23-Jun	0	0	0	5	10	0	0	0	0	0	0	0
24-Jun	0	0	0	15	25	0	0	0	0	0	0	0
25-Jun	2	2	0	47	72	0	0	0	0	0	0	0
26-Jun	8	10	0	53	125	0	0	0	0	0	0	0
27-Jun	3	13	1	101	226	0	0	0	0	0	0	0
28-Jun	23	36	2	242	468	1	0	0	0	0	0	0
29-Jun	1	37	2	73	541	1	0	0	0	0	0	0
30-Jun	0	37	2	143	684	1	0	0	0	0	0	0
1-Jul	92	129	6	785	1,469	2	0	0	0	0	0	0
2-Jul	22	151	7	448	1,917	2	0	0	0	0	0	0
3-Jul	72	223	11	1,142	3,059	4	0	0	0	0	0	0
4-Jul	83	306	15	1,650	4,709	6	0	0	0	0	0	0
5-Jul	52	358	17	1,435	6,144	7	0	0	0	0	0	0
6-Jul	46	404	20	1,898	8,042	10	0	0	0	0	0	0
7-Jul	76	480	23	3,141	11,183	13	0	0	0	0	0	0
8-Jul	269	749	36	3,732	14,915	18	0	0	0	0	0	0
9-Jul	488	1,237	60	5,069	19,984	24	0	0	0	0	0	0
10-Jul	147	1,384	67	4,034	24,018	29	0	0	0	0	0	0
11-Jul	75	1,459	71	3,366	27,384	33	0	0	0	0	0	0
12-Jul	30	1,489	72	3,916	31,300	38	0	0	0	0	0	0
13-Jul	37	1,526	74	3,632	34,932	42	0	0	0	0	0	0
14-Jul	27	1,553	75	2,660	37,592	45	0	0	0	0	0	0
15-Jul	70	1,623	79	2,755	40,347	48	0	0	0	0	0	0
16-Jul	55	1,678	81	3,731	44,078	53	0	0	0	0	0	0
17-Jul	52	1,730	84	3,232	47,310	57	0	0	0	0	0	0
18-Jul	51	1,781	86	3,436	50,746	61	0	0	0	0	0	0
19-Jul [b]	38	1,819	88	2,906	53,652	64	0	0	0	1	1	0
20-Jul	29	1,848	90	2,545	56,197	68	0	0	0	2	3	0
21-Jul	21	1,869	91	2,409	58,606	70	0	0	0	3	6	0
22-Jul	19	1,888	92	1,891	60,497	73	1	1	4	3	9	0
23-Jul	15	1,903	92	1,718	62,215	75	1	2	8	1	10	0
24-Jul	31	1,934	94	2,657	64,872	78	0	2	8	3	13	0
25-Jul	37	1,971	96	2,398	67,270	81	0	2	8	3	16	0
26-Jul	18	1,989	97	1,697	68,967	83	3	5	19	6	22	0
27-Jul	11	2,000	97	2,266	71,233	86	1	6	23	13	35	0

-continued-

Table 1.–Page 2 of 3.

Date	Chinook Salmon Daily	Chinook Salmon Cum.	Chinook Salmon Percent Passage	Chum Salmon Daily	Chum Salmon Cum.	Chum Salmon Percent Passage	Sockeye Salmon Daily	Sockeye Salmon Cum.	Sockeye Salmon Percent Passage	Coho Salmon Daily	Coho Salmon Cum.	Coho Salmon Percent Passage
28-Jul	11	2,011	98	1,950	73,183	88	3	9	34	30	65	1
29-Jul	6	2,017	98	1,291	74,474	89	1	10	38	10	75	1
30-Jul	5	2,022	98	1,113	75,587	91	1	11	42	34	109	1
31-Jul	5	2,027	98	1,024	76,611	92	0	11	42	38	147	2
1-Aug	4	2,031	99	924	77,535	93	0	11	42	50	197	2
2-Aug	3	2,034	99	911	78,446	94	1	12	45	23	220	3
3-Aug	4	2,038	99	850	79,296	95	1	13	49	44	264	3
4-Aug	4	2,042	99	719	80,015	96	1	14	53	59	323	4
5-Aug	2	2,044	99	446	80,461	97	0	14	53	101	424	5
6-Aug [c]	3	2,047	99	513	80,974	97	0	14	54	126	550	6
7-Aug [c]	2	2,049	99	444	81,417	98	1	15	56	172	722	8
8-Aug [c]	2	2,051	100	374	81,791	98	0	15	57	218	940	11
9-Aug [c]	2	2,053	100	305	82,096	99	0	15	58	264	1,204	14
10-Aug [c]	1	2,054	100	235	82,332	99	0	15	58	310	1,513	17
11-Aug [c]	1	2,055	100	166	82,498	99	1	16	58	356	1,869	22
12-Aug	0	2,055	100	77	82,575	99	0	16	58	381	2,250	26
13-Aug	1	2,056	100	116	82,691	99	0	16	58	422	2,672	31
14-Aug	0	2,056	100	84	82,775	99	0	16	58	439	3,111	36
15-Aug	0	2,056	100	52	82,827	99	0	16	58	228	3,339	38
16-Aug	0	2,056	100	67	82,894	100	1	17	62	275	3,614	42
17-Aug	0	2,056	100	54	82,948	100	2	19	70	353	3,967	46
18-Aug	0	2,056	100	45	82,993	100	3	22	81	343	4,310	50
19-Aug	0	2,056	100	32	83,025	100	0	22	81	255	4,565	53
20-Aug	1	2,057	100	37	83,062	100	1	23	85	424	4,989	57
21-Aug	0	2,057	100	25	83,087	100	0	23	85	500	5,489	63
22-Aug	0	2,057	100	27	83,114	100	0	23	85	343	5,832	67
23-Aug	0	2,057	100	19	83,133	100	0	23	85	201	6,033	69
24-Aug	1	2,058	100	14	83,147	100	0	23	85	258	6,291	72
25-Aug	0	2,058	100	15	83,162	100	0	23	85	377	6,668	77
26-Aug	0	2,058	100	10	83,172	100	0	23	85	176	6,844	79
27-Aug	2	2,060	100	11	83,183	100	1	24	89	215	7,059	81
28-Aug	0	2,060	100	8	83,191	100	0	24	89	319	7,378	85
29-Aug	0	2,060	100	4	83,195	100	1	25	92	229	7,607	88
30-Aug	0	2,060	100	5	83,200	100	1	26	96	84	7,691	89
31-Aug	0	2,060	100	4	83,204	100	0	26	96	173	7,864	91
1-Sep	0	2,060	100	6	83,210	100	0	26	96	112	7,976	92
2-Sep	0	2,060	100	1	83,211	100	0	26	96	97	8,073	93
3-Sep	0	2,060	100	8	83,219	100	0	26	96	56	8,129	94
4-Sep	0	2,060	100	6	83,225	100	0	26	96	95	8,224	95
5-Sep	0	2,060	100	7	83,232	100	0	26	96	62	8,286	95
6-Sep	1	2,061	100	5	83,237	100	1	27	100	77	8,363	96
7-Sep	0	2,061	100	2	83,239	100	0	27	100	51	8,414	97
8-Sep	0	2,061	100	1	83,240	100	0	27	100	50	8,464	97
9-Sep	0	2,061	100	2	83,242	100	0	27	100	54	8,518	98
10-Sep [b]	0	2,061	100	2	83,244	100	0	27	100	41	8,559	99

-continued-

Table 1.–Page 3 of 3.

Date	Chinook Salmon			Chum Salmon			Sockeye Salmon			Coho Salmon		
	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage
11-Sep	0	2,061	100	0	83,244	100	0	27	100	21	8,580	99
12-Sep	0	2,061	100	1	83,245	100	0	27	100	39	8,619	99
13-Sep	0	2,061	100	1	83,246	100	0	27	100	32	8,651	100
14-Sep	0	2,061	100	0	83,246	100	0	27	100	13	8,664	100
15-Sep	0	2,061	100	0	83,246	100	0	27	100	8	8,672	100
16-Sep [d]	0	2,061	100	0	83,246	100	0	27	100	5	8,677	100
17-Sep [d]	0	2,061	100	0	83,246	100	0	27	100	6	8,683	100
18-Sep [d]	0	2,061	100	0	83,246	100	0	27	100	2	8,685	100
19-Sep [d]	0	2,061	100	0	83,246	100	0	27	100	0	8,685	100
20-Sep [d]	0	2,061	100	0	83,246	100	0	27	100	0	8,685	100

[a] Date outside of target operational period; daily passage not included in cumulative escapement.

[b] A hole was discovered in the weir; daily passage was estimated using the "single-day method" as defined in the methods.

[c] Weir was not operational; daily passage was estimated from linear interpolation.

[d] Weir was removed early due to anticipated flood conditions; passage was estimated based on the "proportion method" as defined in the methods.

Table 2.–Age and sex composition of Chinook salmon at the Tatlawiksuk River weir in 2007 based on escapement samples collected with a live trap.

			Age Class																	
Sample Dates	Sample		1.1		1.2		1.3		2.2		1.4		2.3		1.5		2.4		Total	
(Stratum Dates)	Size	Sex	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%
6/29-7/9	174	M	8	0.6	541	39.1	477	34.5	0	0.0	72	5.2	0	0.0	0	0.0	8	0.6	1,106	79.9
(6/15-7/10)		F	0	0.0	0	0.0	112	8.0	0	0.0	167	12.0	0	0.0	0	0.0	0	0.0	278	20.1
		Subtotal[a]	8	0.6	541	39.1	589	42.5	0	0.0	239	17.2	0	0.0	0	0.0	8	0.6	1,384	100.0
7/12-15	53	M	0	0.0	91	26.4	98	28.3	0	0.0	19	5.7	0	0.0	0	0.0	0	0.0	209	60.4
(7/11-17)		F	0	0.0	0	0.0	59	17.0	0	0.0	72	20.7	0	0.0	7	1.9	0	0.0	137	39.6
		Subtotal[a]	0	0.0	91	26.4	157	45.3	0	0.0	91	26.4	0	0.0	7	1.9	0	0.0	346	100.0
7/19-8/2	48	M	0	0.0	76	22.9	83	25.0	0	0.0	21	6.2	0	0.0	7	2.1	0	0.0	186	56.3
(7/18-9/20)		F	0	0.0	7	2.1	76	22.9	0	0.0	55	16.7	0	0.0	7	2.1	0	0.0	145	43.7
		Subtotal[a]	0	0.0	83	25.0	159	47.9	0	0.0	76	22.9	0	0.0	14	4.2	0	0.0	331	100.0
Season[b]	275	M	8	0.4	708	34.4	658	31.9	0	0.0	112	5.4	0	0.0	7	0.3	8	0.4	1,501	72.8
		F	0	0.0	7	0.3	246	12.0	0	0.0	294	14.3	0	0.0	13	0.7	0	0.0	560	27.2
		Total	8	0.4	715	34.7	904	43.9	0	0.0	406	19.7	0	0.0	20	1.0	8	0.4	2,061	100.0

Note: Sample sizes for each age-sex class are provided in Table 3.

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding errors.

[b] The number of fish in "Season" summaries are the strata sums; "Season" percentages are derived from the sums of the estimated escapement that occurred in each stratum.

Table 3.–Mean length (mm) of Chinook salmon at the Tatlawiksuk River weir in 2007 based on escapement samples collected with a live trap.

Sample Dates (Stratum Dates)	Sex		Age Class 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4
6/29-7/9 (6/15-7/10)	M	Mean Length	380	545	657		758			773
		SE	-	4	6		28			-
		Range	380- 380	454- 635	534- 773		619- 870			773- 773
		Sample Size	1	68	60	0	9	0	0	1
	F	Mean Length			678		803			
		SE			6		19			
		Range			641- 715		675- 972			
		Sample Size	0	0	14	0	21	0	0	0
7/12-15 (7/11-17)	M	Mean Length		546	684		706			
		SE		8	16		29			
		Range		490- 585	586- 820		654- 756			
		Sample Size	0	14	15	0	3	0	0	0
	F	Mean Length			676		826		774	
		SE			13		20		-	
		Range			604- 729		742- 934		774- 774	
		Sample Size	0	0	9	0	11	0	1	0
7/19-8/2 (7/18-9/20)	M	Mean Length		545	683		722		895	
		SE		16	12		42		-	
		Range		460- 650	605- 750		640- 777		895- 895	
		Sample Size	0	11	12	0	3	0	1	0
	F	Mean Length		715	707		784		763	
		SE		-	11		18		-	
		Range		715- 715	655- 790		724- 874		763- 763	
		Sample Size	0	1	11	0	8	0	1	0
Season[a]	M	Mean Length	380	545	664		742		895	773
		Range	380- 380	454- 650	534- 820		619- 870		895- 895	773- 773
		Sample Size	1	93	87	0	15	0	1	1
	F	Mean Length		715	687		805		768	
		Range		715- 715	604- 790		675- 972		763- 774	
		Sample Size	0	1	34	0	40	0	2	0

[a] "Season" mean lengths are weighted by abundance in each stratum.

Table 4.–Age and sex composition of chum salmon at the Tatlawiksuk River weir in 2007 based on escapement samples collected with a live trap.

Sample Dates (Stratum Dates)	Sample Size	Sex	Age Class 0.2 Esc.	0.2 %	0.3 Esc.	0.3 %	0.4 Esc.	0.4 %	0.5 Esc.	0.5 %	Total Esc.	Total %
6/29-30	196	M	24	0.5	1,994	42.3	745	15.8	24	0.5	2,787	59.2
(6/15-7/4)		F	48	1.0	1,418	30.1	408	8.7	48	1.0	1,922	40.8
		Subtotal[a]	72	1.5	3,412	72.4	1,153	24.5	72	1.5	4,709	100.0
7/8-9	181	M	0	0.0	11,459	43.1	2,938	11.0	147	0.6	14,544	54.7
(7/5-12)		F	735	2.8	9,549	35.9	1,616	6.1	147	0.5	12,047	45.3
		Subtotal[a]	735	2.8	21,008	79.0	4,554	17.1	294	1.1	26,591	100.0
7/15	181	M	413	1.7	7,841	31.5	2,338	9.4	0	0.0	10,592	42.5
(7/13-20)		F	825	3.3	12,517	50.3	963	3.9	0	0.0	14,305	57.5
		Subtotal[a]	1,238	5.0	20,358	81.8	3,301	13.3	0	0.0	24,897	100.0
7/25-26	180	M	0	0.0	7,258	35.6	2,155	10.6	0	0.0	9,413	46.1
(7/21-31)		F	340	1.7	9,300	45.5	1,247	6.1	113	0.6	11,001	53.9
		Subtotal[a]	340	1.7	16,558	81.1	3,402	16.7	113	0.6	20,414	100.0
8/5	182	M	0	0.0	1,823	27.5	547	8.2	0	0.0	2,370	35.7
(8/1-9/20)		F	401	6.0	3,645	54.9	219	3.3	0	0.0	4,265	64.3
		Subtotal[a]	401	6.0	5,468	82.4	766	11.5	0	0.0	6,635	100.0
Season[b]	920	M	437	0.5	30,375	36.5	8,723	10.5	171	0.2	39,706	47.7
		F	2,349	2.8	36,429	43.7	4,454	5.3	308	0.4	43,540	52.3
		Total	2,786	3.3	66,804	80.2	13,177	15.8	479	0.6	83,246	100.0

Note: Sample sizes for each age-sex class are provided in Table 5.

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding errors.

[b] The number of fish in "Season" summaries are strata sums; "Season" percentages are derived from the sums of the estimated escapement that occurred in each stratum.

Table 5.–Mean length (mm) of chum salmon at the Tatlawiksuk River weir in 2007 based on escapement samples collected with a live trap.

Sample Dates (Stratum Dates)	Sex		Age Class 0.2	0.3	0.4	0.5
6/29-30	M	Mean Length	533	569	577	628
(6/15-7/4)		SE	-	3	4	-
		Range	533- 533	515- 632	518- 620	628- 628
		Sample Size	1	83	31	1
	F	Mean Length	547	549	557	586
		SE	7	3	7	2
		Range	540- 553	485- 608	510- 615	584- 588
		Sample Size	2	59	17	2
7/8-9	M	Mean Length		564	580	574
(7/5-12)		SE		3	6	-
		Range		503- 626	543- 639	574- 574
		Sample Size	0	78	20	1
	F	Mean Length	520	540	535	565
		SE	16	3	7	-
		Range	493- 577	499- 595	503- 567	565- 565
		Sample Size	5	65	11	1
7/15	M	Mean Length	551	562	574	
(7/13-20)		SE	7	4	6	
		Range	542- 564	512- 655	537- 615	
		Sample Size	3	57	17	0
	F	Mean Length	525	537	530	
		SE	8	3	12	
		Range	504- 553	477- 611	481- 569	
		Sample Size	6	91	7	0
7/25-26	M	Mean Length		555	563	
(7/21-31)		SE		4	10	
		Range		447- 610	435- 650	
		Sample Size	0	64	19	0
	F	Mean Length	529	535	528	497
		SE	19	3	11	-
		Range	491- 549	475- 586	437- 572	497- 497
		Sample Size	3	82	11	1
8/5	M	Mean Length		553	553	
(8/1-9/20)		SE		3	9	
		Range		492- 608	479- 613	
		Sample Size	0	50	15	0
	F	Mean Length	502	527	537	
		SE	11	3	5	
		Range	422- 558	469- 595	522- 552	
		Sample Size	11	100	6	0
Season[a]	M	Mean Length	550	561	572	582
		Range	533- 564	447- 655	435- 650	574- 628
		Sample Size	4	332	102	2
	F	Mean Length	521	537	534	543
		Range	422- 577	469- 611	437- 615	497- 588
		Sample Size	27	397	52	4

[a] "Season" mean lengths are weighted by abundance in each stratum.

Table 6.–Age and sex composition of coho salmon at Tatlawiksuk River weir in 2007 based on escapement samples collected with a live trap.

			Age Class							
Sample Dates	Sample		1.1		2.1		3.1		Total	
(Stratum Dates)	Size	Sex	Esc.	%	Esc.	%	Esc.	%	Esc.	%
(6/15-8/13)	0	Subtotal [a]							2,672	
8/20-21	139	M	130	3.6	1,484	41.0	104	2.9	1,718	47.5
(8/14-24)		F	78	2.2	1,692	46.8	130	3.6	1,901	52.5
		Subtotal [a]	208	5.8	3,176	87.8	234	6.5	3,619	100.0
8/29-30	137	M	37	2.2	615	36.5	49	2.9	701	41.6
(8/25-9/1)		F	37	2.2	849	50.4	99	5.9	984	58.4
		Subtotal [a]	74	4.4	1,464	86.9	148	8.8	1,685	100.0
9/5-7	143	M	15	2.1	317	44.8	5	0.7	337	47.6
(9/2-20)		F	0	0.0	352	49.6	20	2.8	372	52.4
		Subtotal [a]	15	2.1	669	94.4	25	3.5	709	100.0
		M								
		F								
Season [b]	419	Total	426	4.9	7,668	88.3	591	6.8	8,685	100.0

Note: Sample sizes for each age-sex class are provided in Table 7.

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding errors.

[b] The number of fish in "Season" summaries are strata sums; "Season" percentages are derived from the sums of the estimated escapement that occurred in each stratum.

Table 7.–Mean length (mm) of coho salmon at the Tatlawiksuk River weir in 2007 based on escapement samples collected with a live trap.

Sample Dates (Stratum Dates)	Sex		Age Class 1.1	2.1	3.1
(6/15-8/13)		Sample Size	0	0	0
8/20-21 (8/14-24)	M	Mean Length	527	527	551
		SE	17	7	19
		Range	499- 592	380- 610	505- 594
		Sample Size	5	57	4
	F	Mean Length	545	553	537
		SE	12	4	25
		Range	520- 558	468- 593	447- 600
		Sample Size	3	65	5
8/29-30 (8/25-9/1)	M	Mean Length	566	552	567
		SE	74	7	9
		Range	438- 694	428- 635	545- 587
		Sample Size	3	50	4
	F	Mean Length	525	560	556
		SE	11	4	8
		Range	509- 545	420- 613	525- 586
		Sample Size	3	69	8
9/5-7 (9/2-20)	M	Mean Length	547	554	545
		SE	33	6	-
		Range	484- 596	370- 638	545- 545
		Sample Size	3	64	1
	F	Mean Length		558	575
		SE		3	23
		Range		486- 602	512- 613
		Sample Size	0	71	4
Total Sample [a]	M	Mean Length	535	537	555
		Range	438- 694	370- 638	505- 594
		Sample Size	11	171	9
	F	Mean Length	539	556	546
		Range	509- 558	420- 613	447- 613
		Sample Size	6	205	17

[a] "Total Sample" mean lengths are weighted by abundance in each stratum.

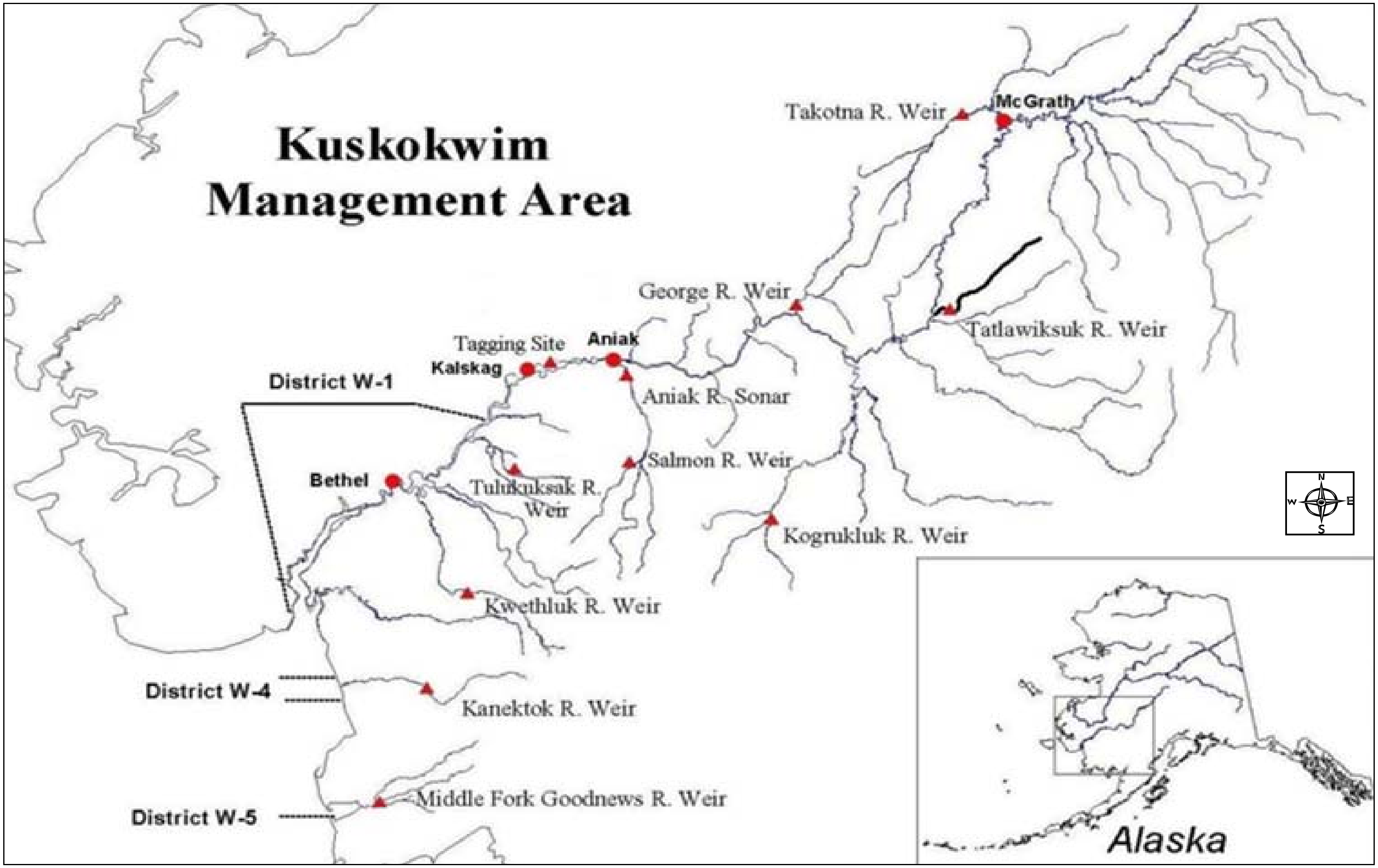


Figure 1.–Location of Kuskokwim Area salmon management districts and escapement monitoring projects with emphasis on the Tatlawiksuk River.

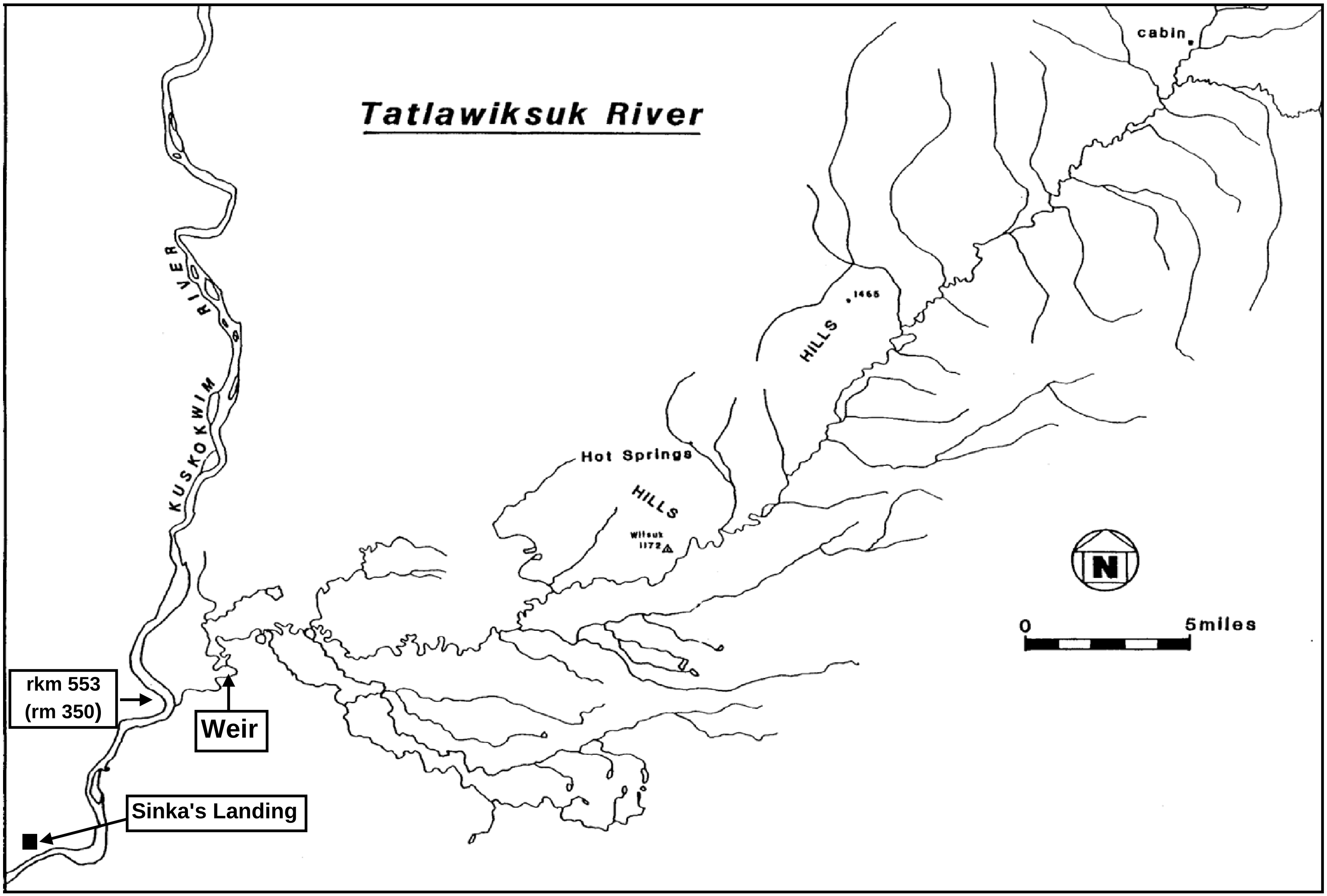
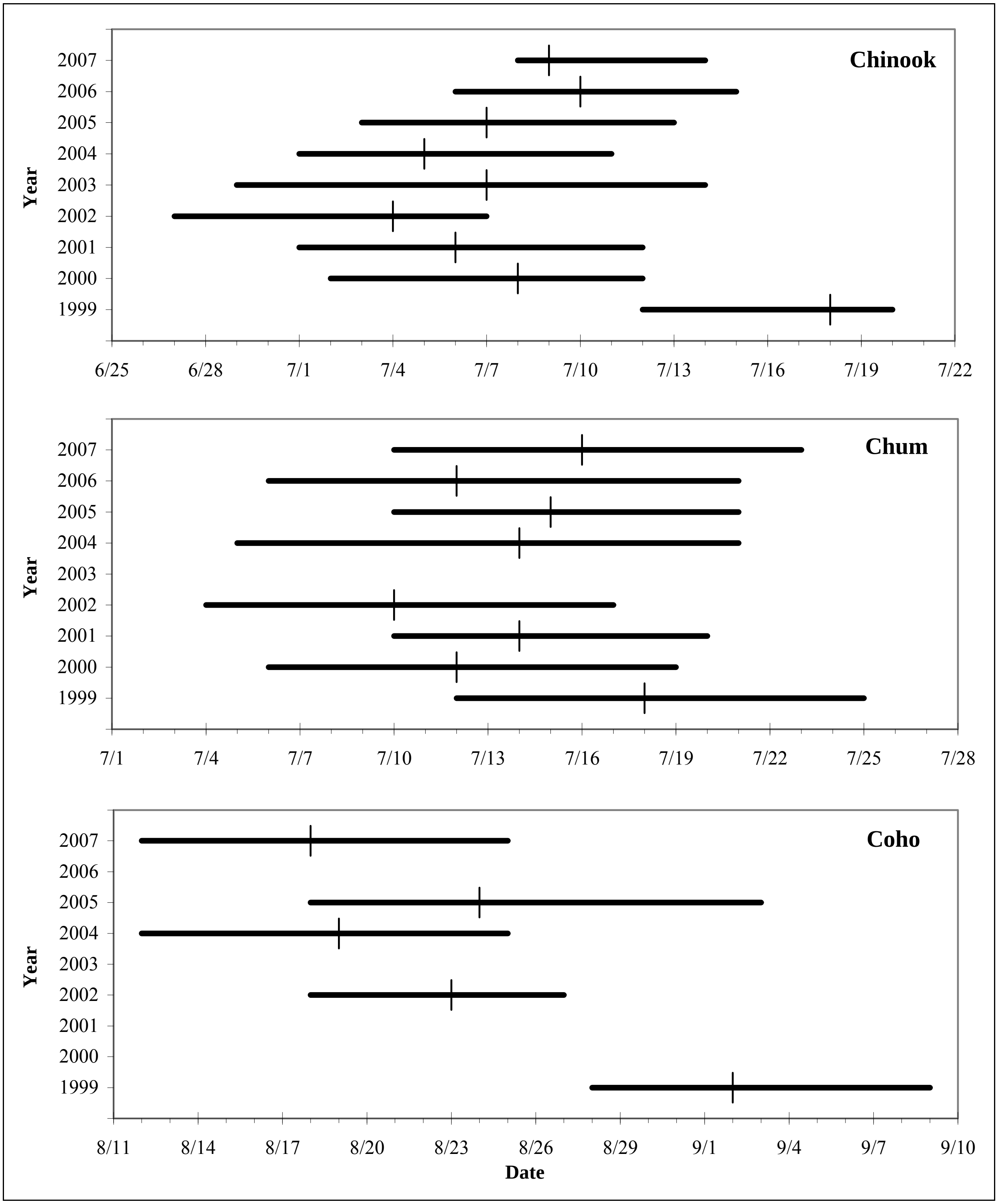
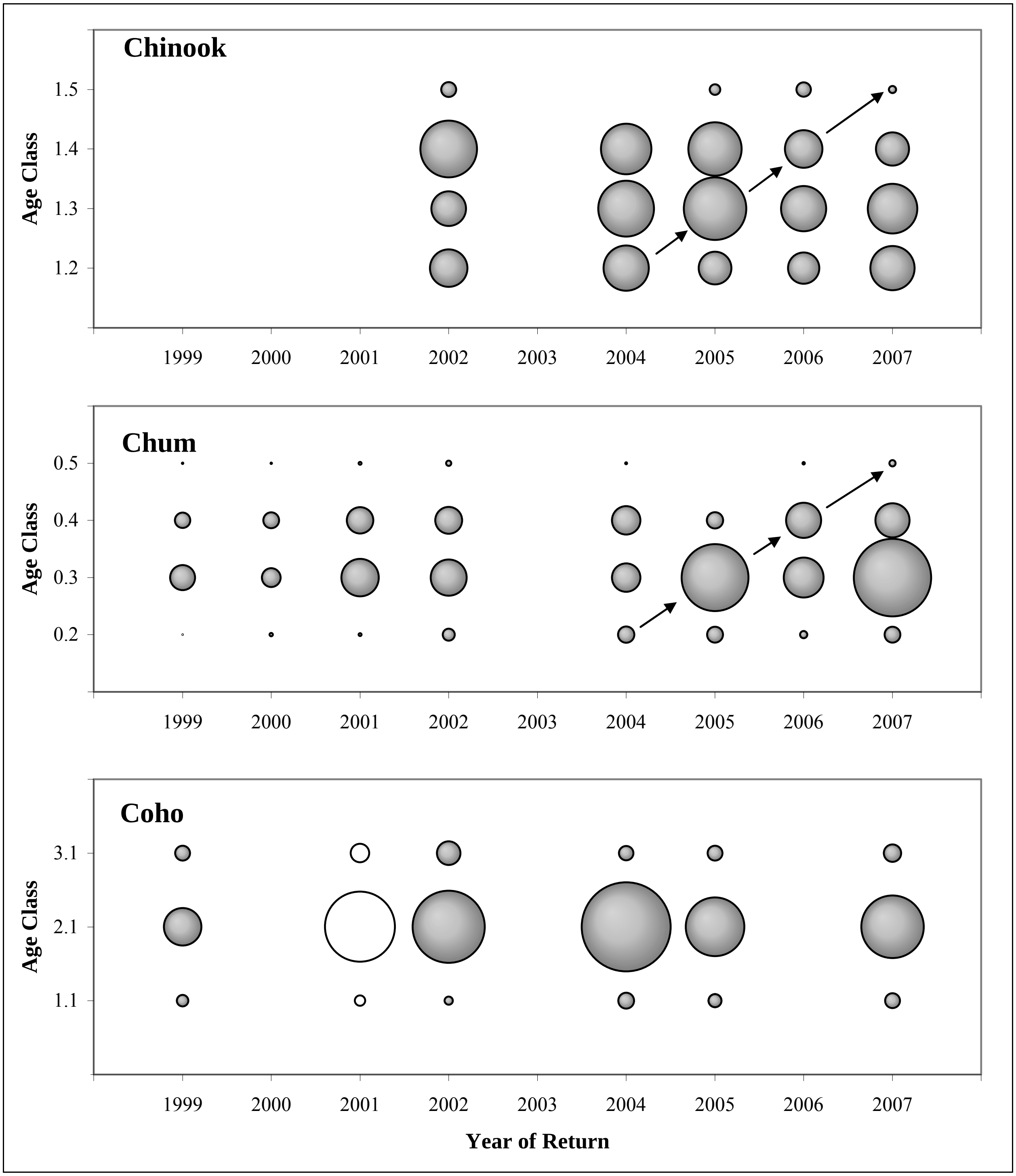


Figure 2.–Tatlawiksuk River drainage and the location of the weir.



Note: Solid lines represent the dates when the central 50% of the run passed and cross-bars represent the median passage date.

Figure 3.–Annual run timing of Chinook, chum, and coho salmon based on cumulative percent passage at the Tatlawiksuk River weir, 1999–2007.



Note: Size of circles represent relative abundance and arrows illustrate tracking a cohort group. Plots that appear empty (white) correspond to years when greater than 20% of reported escapement was derived from daily passage estimates. Years when sample objectives were not achieved contain no data plots.

Figure 4.–Relative age-class abundance of Chinook, chum, and coho salmon by return year at Tatlawiksuk River weir, 1999–2007.

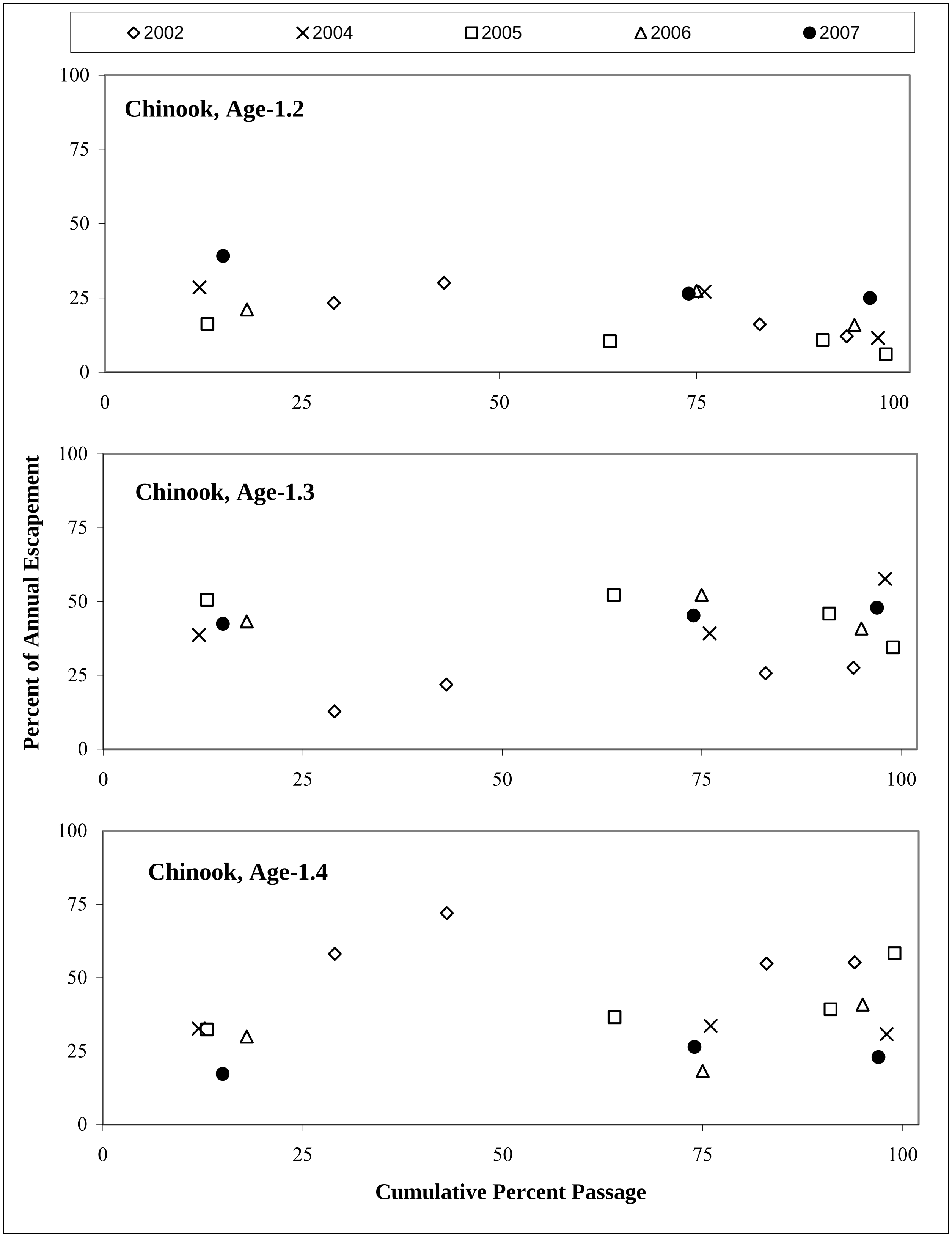


Figure 5.–Historical age composition of Chinook salmon by cumulative percent passage at Tatlawiksuk River weir.

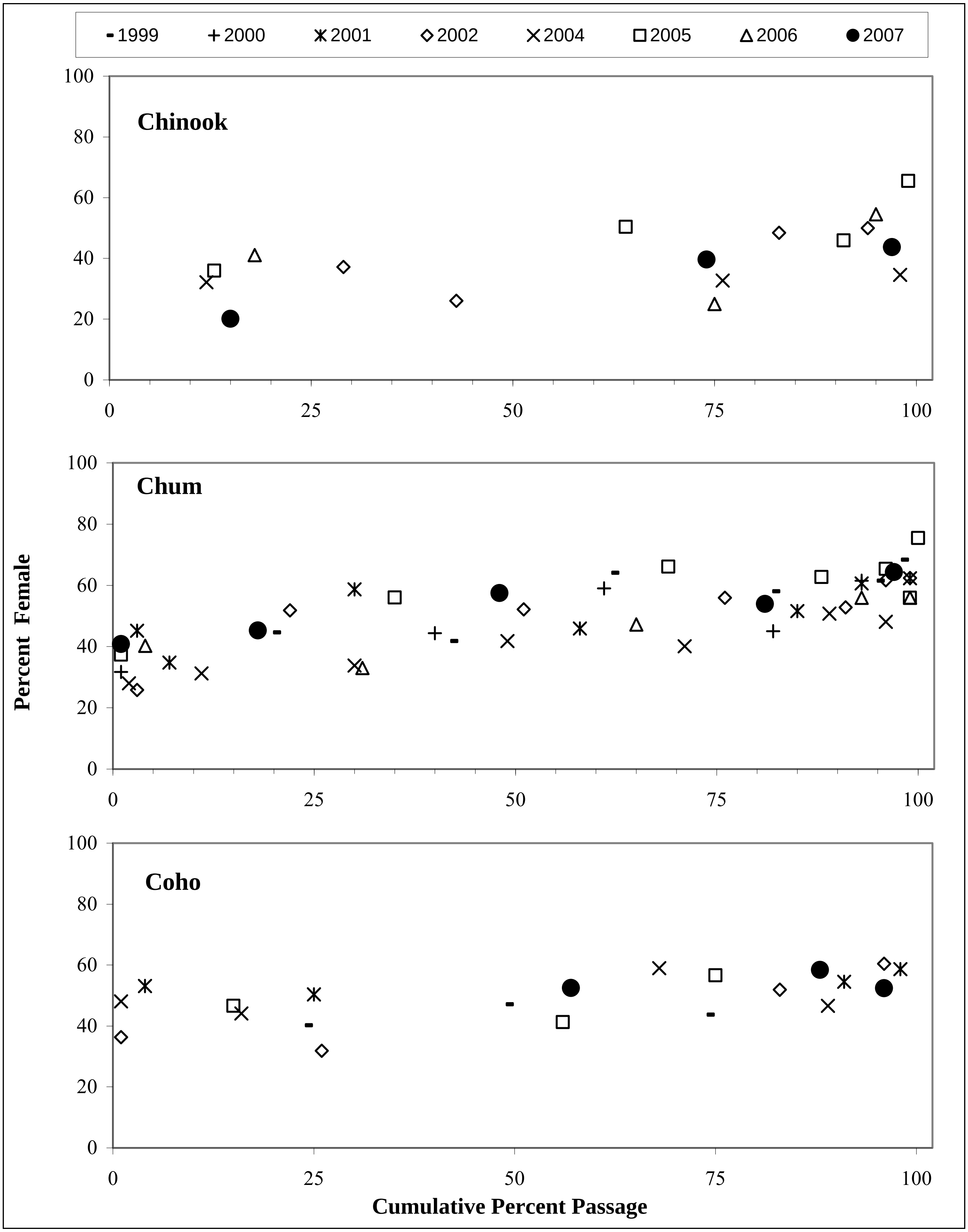
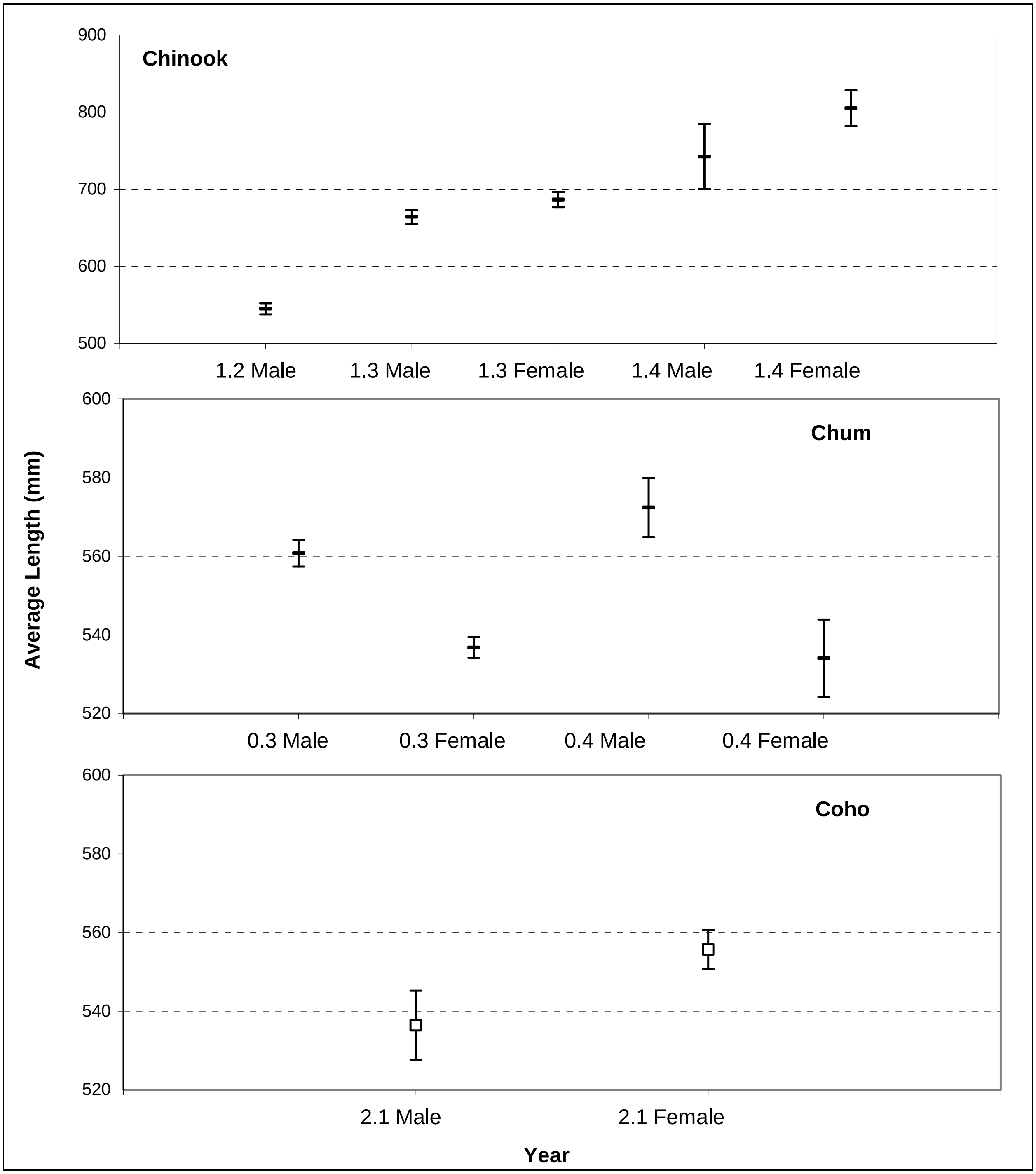


Figure 6.–Historical percentage of female Chinook, chum, and coho salmon by cumulative percent passage at the Tatlawiksuk River weir.



Note: Mean length estimate of coho salmon were limited to only the latter two thirds of escapement.

Figure 7.–Mean length-at-age of male and female Chinook, chum, and coho salmon at the Tatlawiksuk River weir in 2007, with 95% confidence intervals.

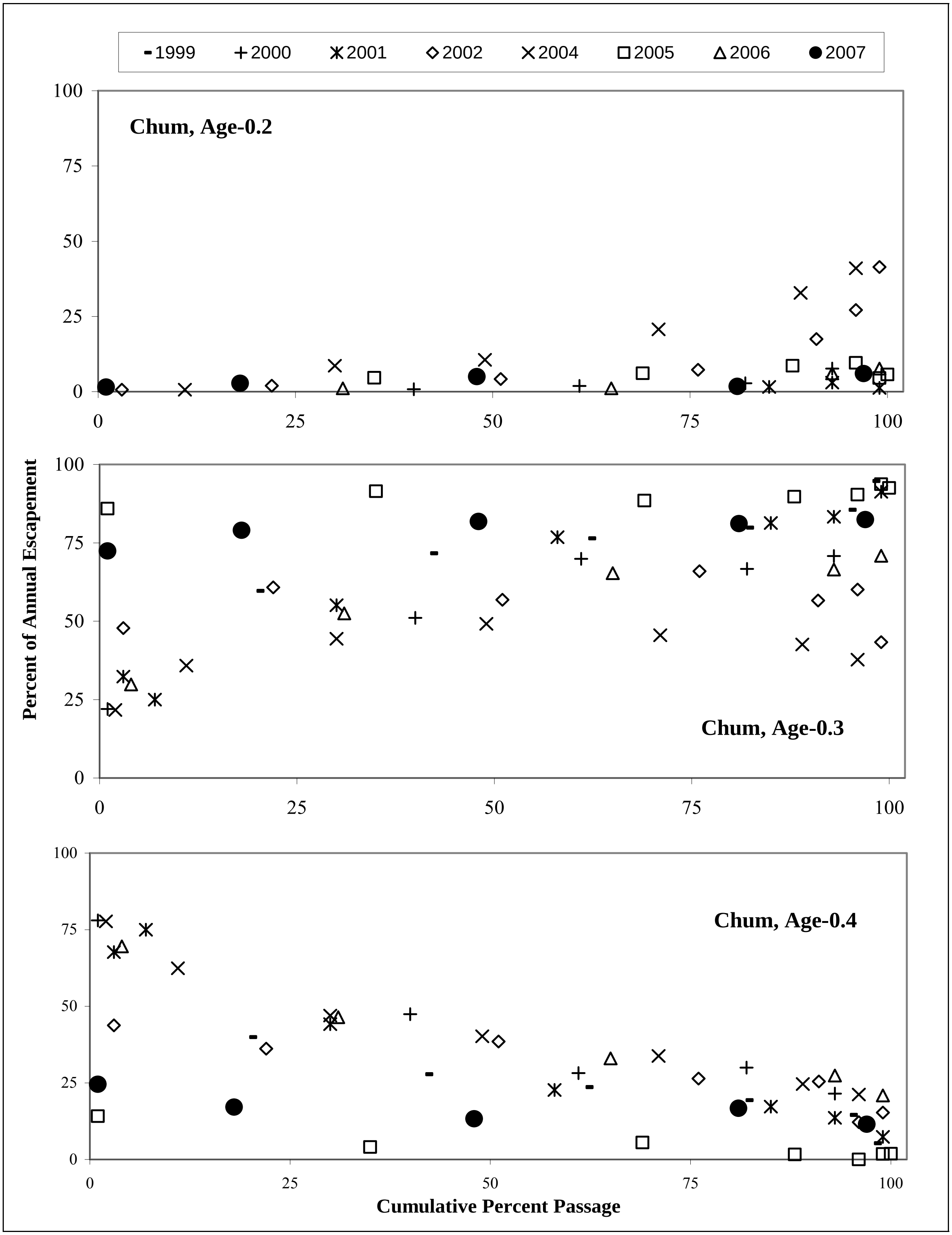


Figure 8.–Historical age composition of chum salmon by cumulative percent passage at Tatlawiksuk River weir.

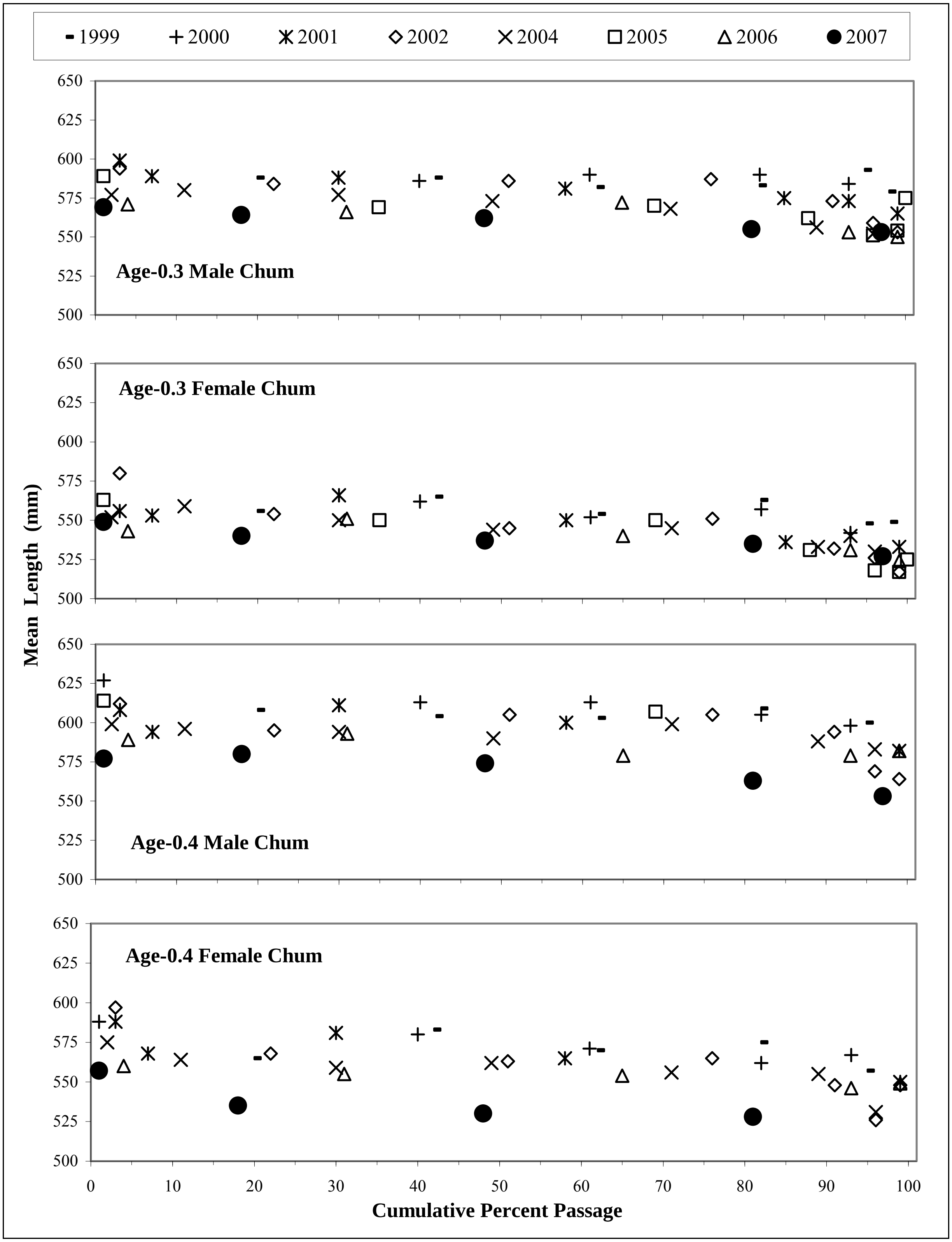


Figure 9.–Historical mean length-at-age of chum salmon by cumulative percent passage at the Tatlawiksuk River weir.

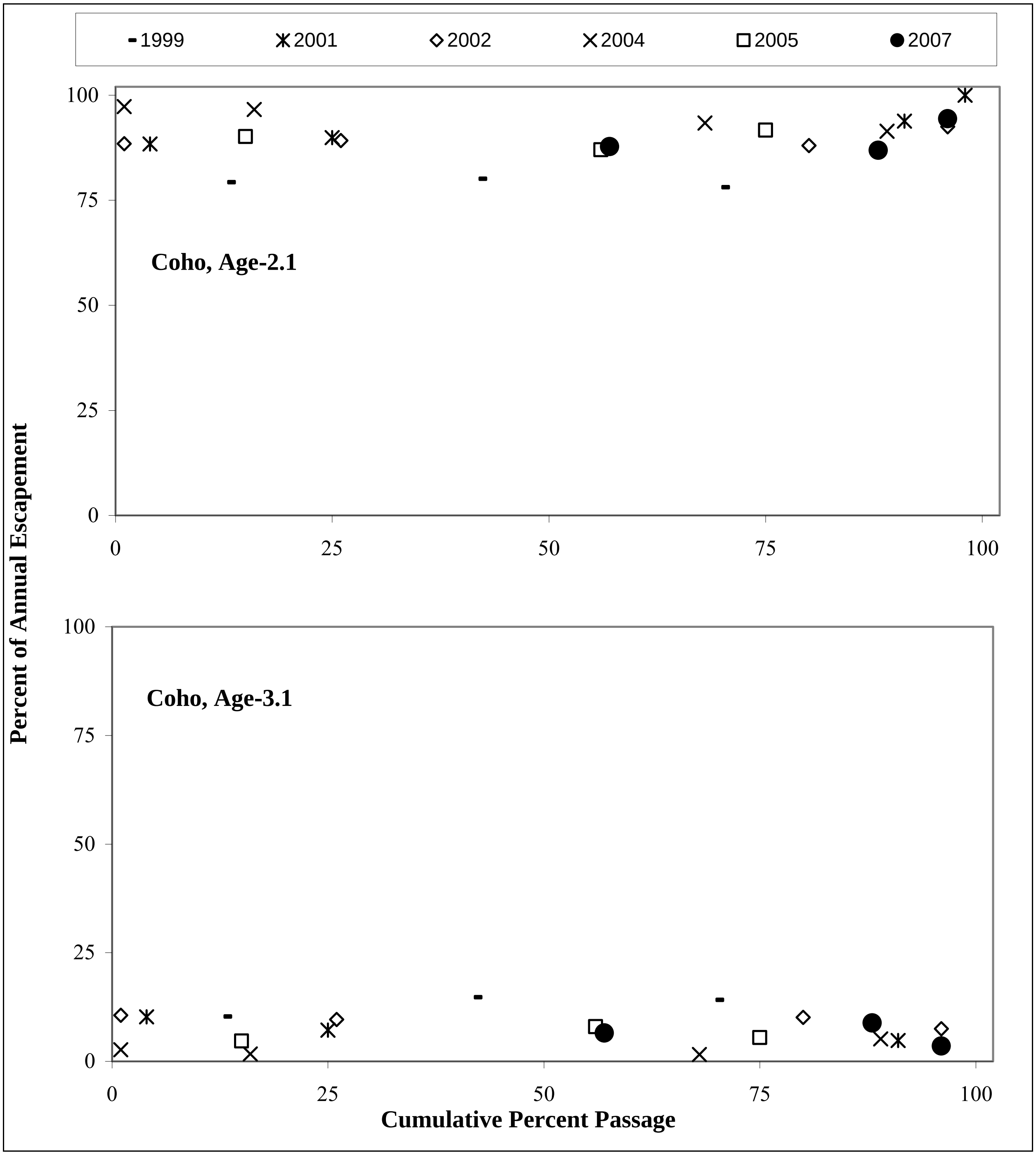


Figure 10.–Historical age composition of coho salmon by cumulative percent passage at Tatlawiksuk River weir.

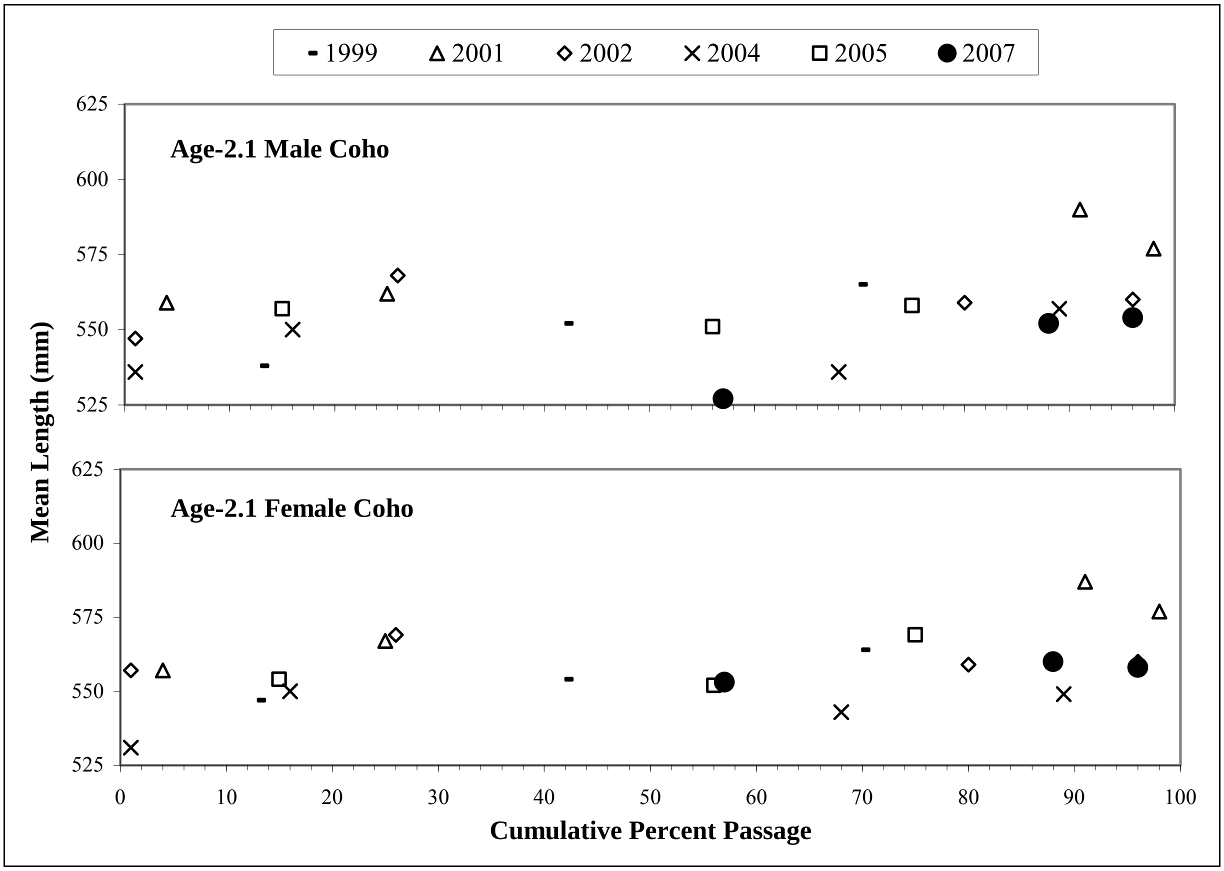


Figure 11.–Historical mean length of male and female age-2.1 coho salmon by cumulative percent passage at Tatlawiksuk River weir.

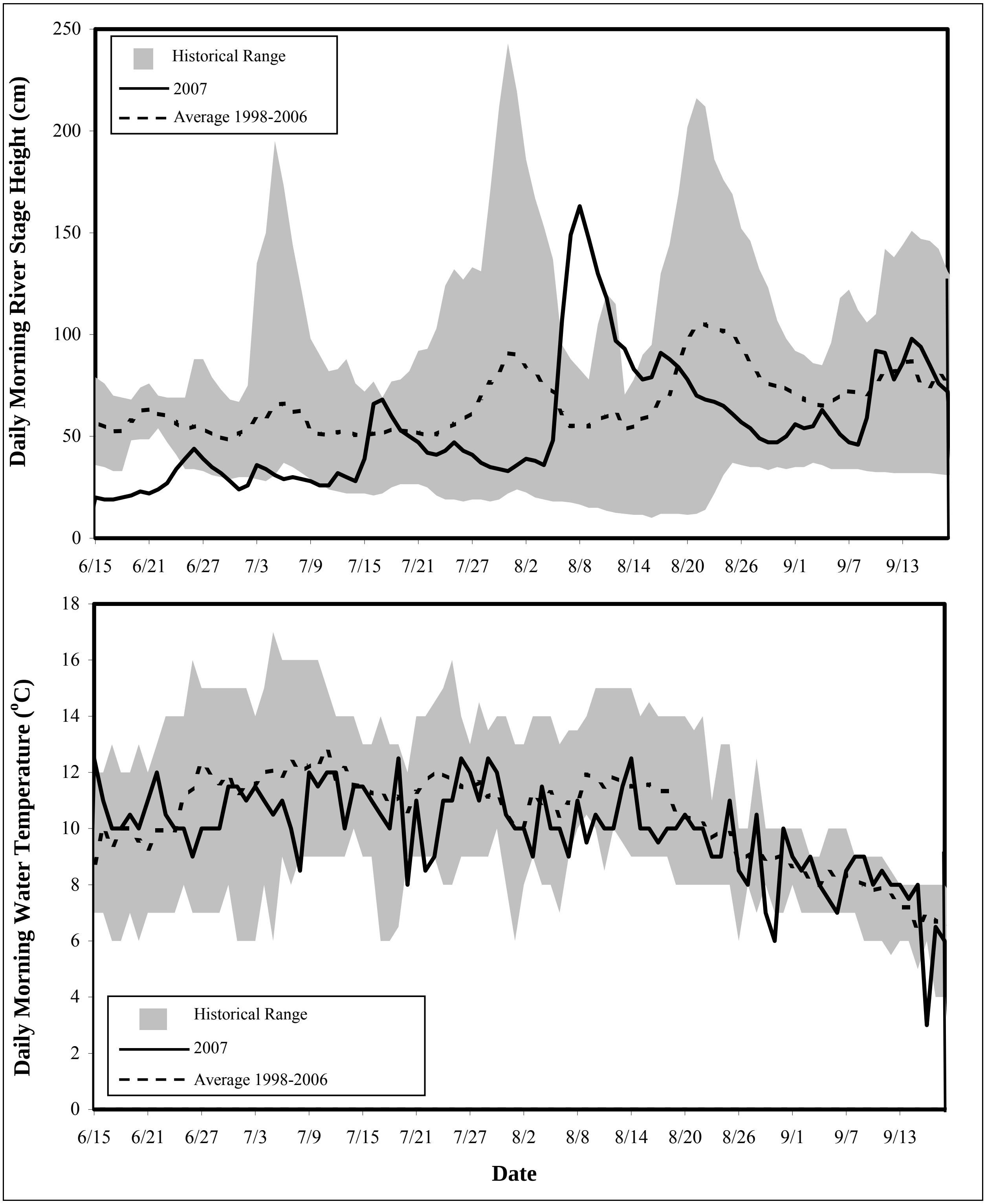


Figure 12.–Comparison of daily morning river stage and temperature measurements in 2007 with historical range and averages at Tatlawiksuk river weir.

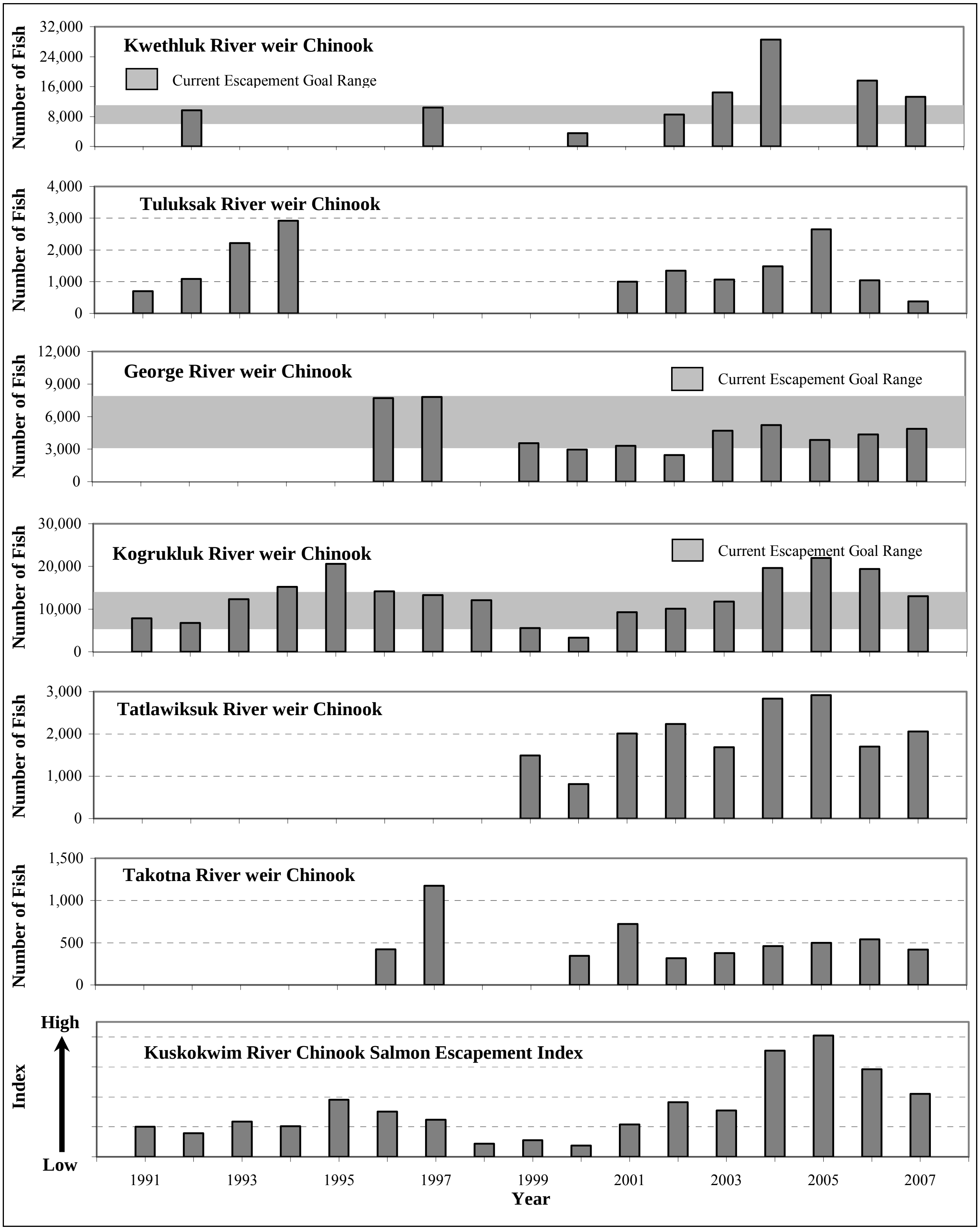


Figure 13.–Annual Chinook salmon escapement into 6 Kuskokwim River tributaries and the Kuskokwim River Chinook salmon escapement indices, 1991-2007.

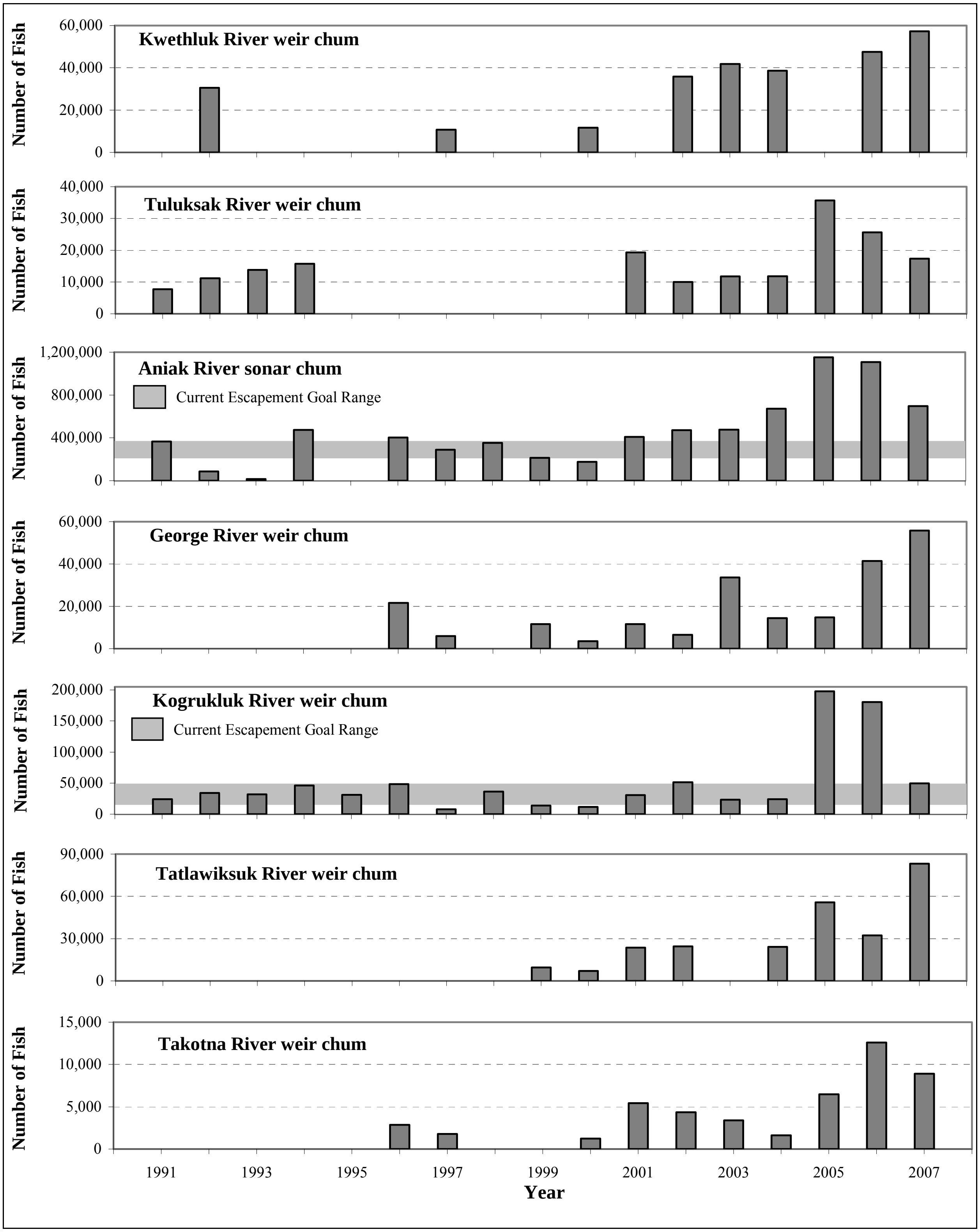


Figure 14.–Annual chum salmon escapement into 7 Kuskokwim River tributaries, 1991-2007.

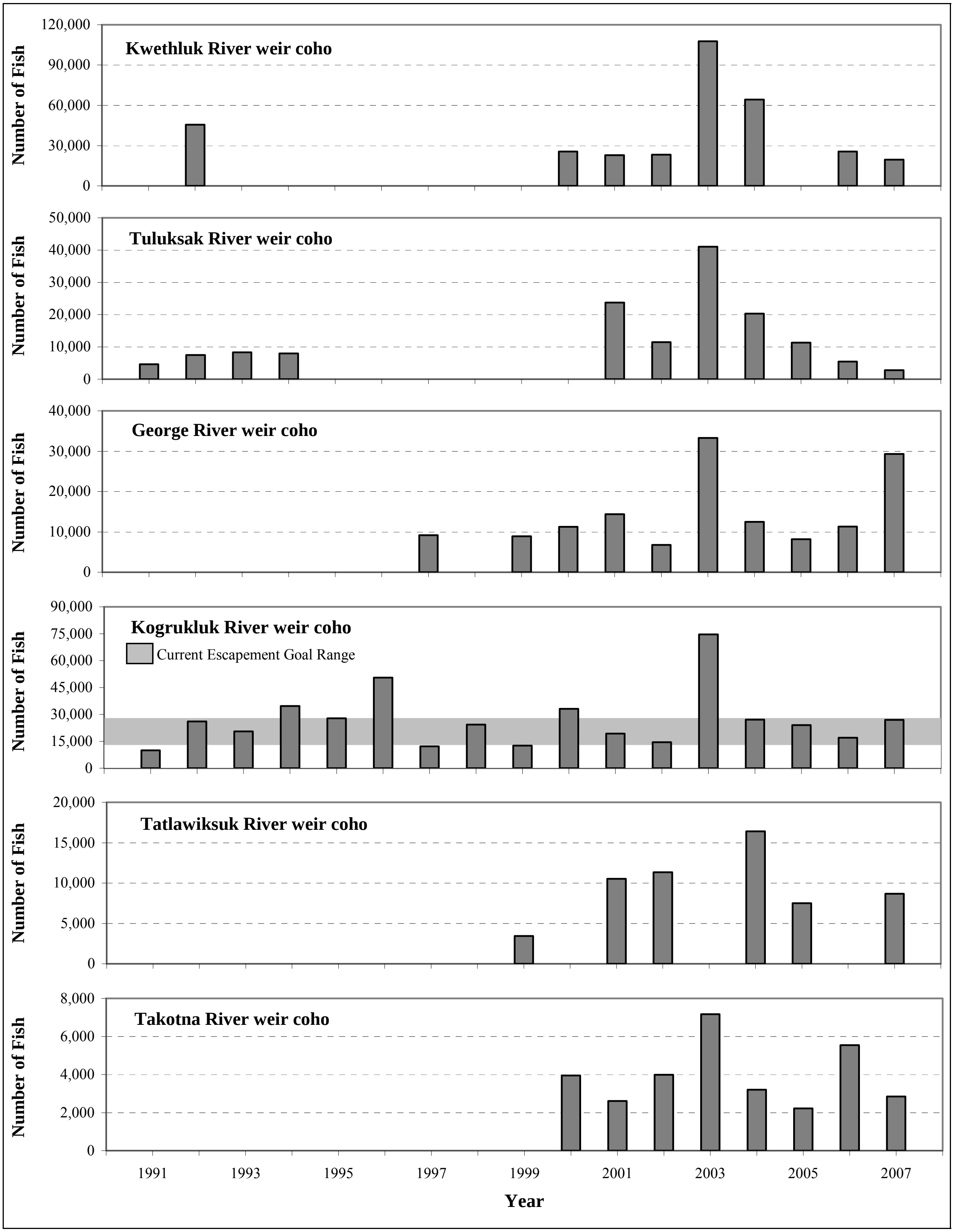


Figure 15.–Annual coho salmon escapement into 6 Kuskokwim River tributaries, 1991–2007.

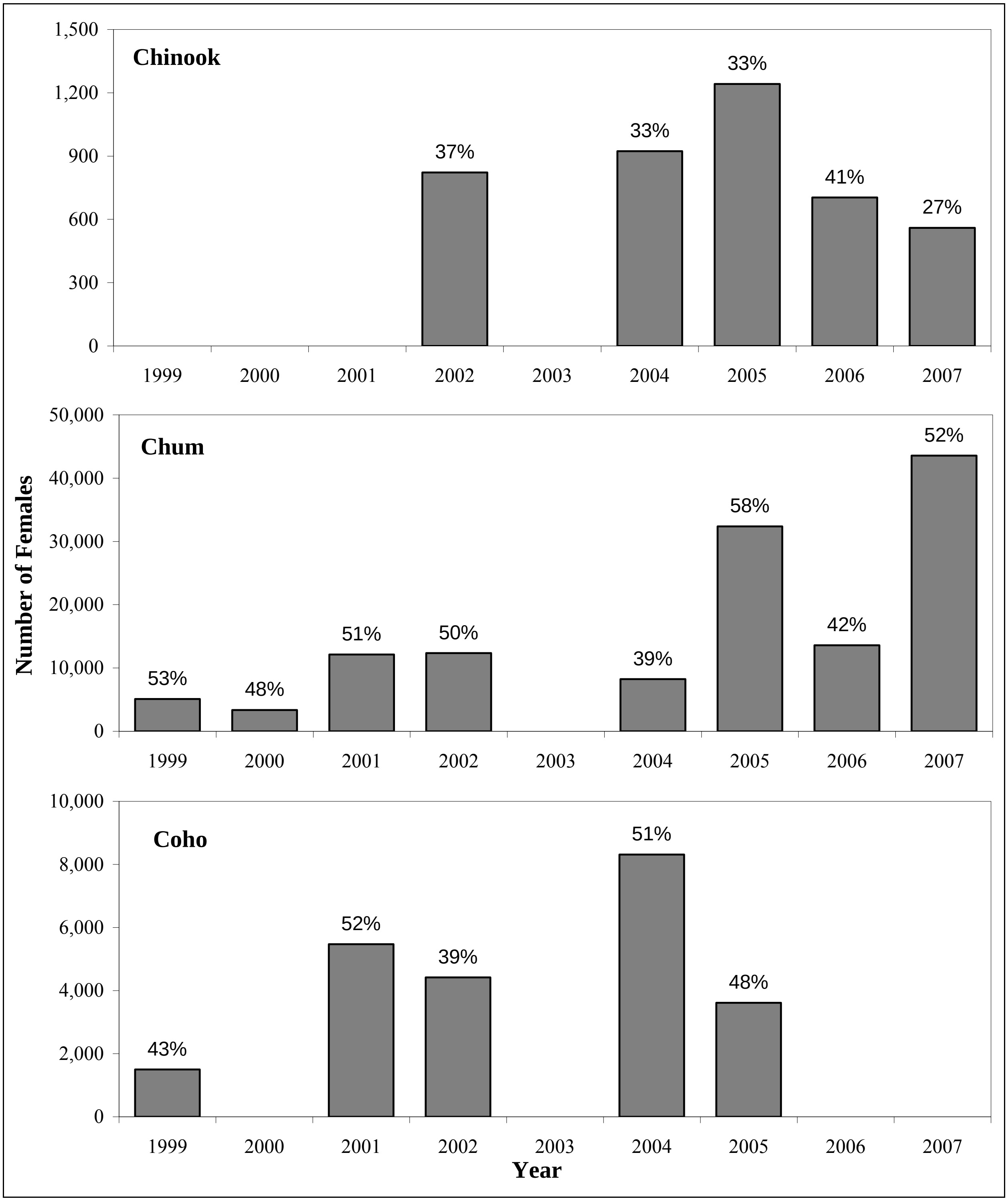


Figure 16.–Historical annual escapement of female salmon at Tatlawiksuk River weir, with labels indicating the percent of total escapement comprised of females.

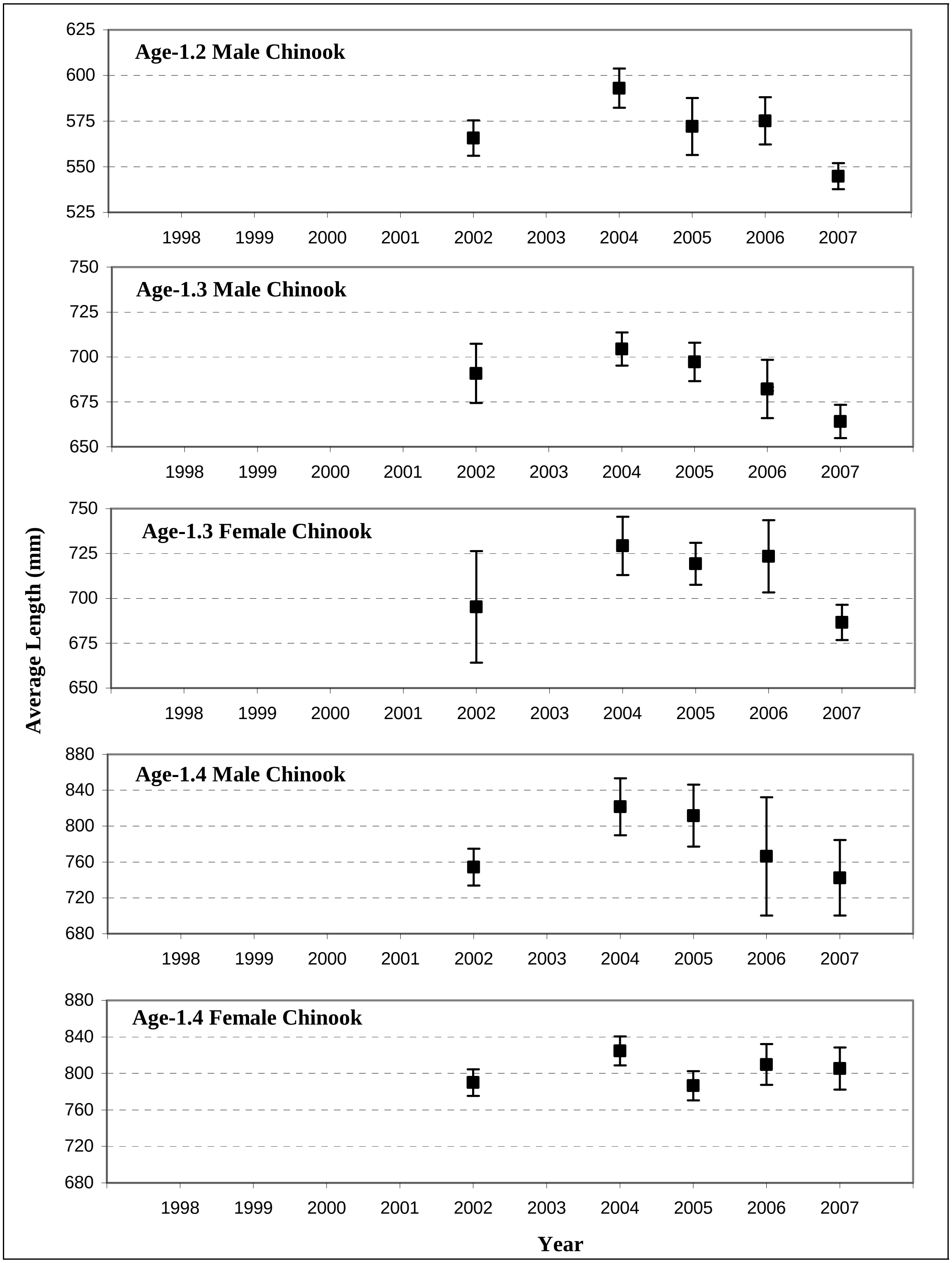
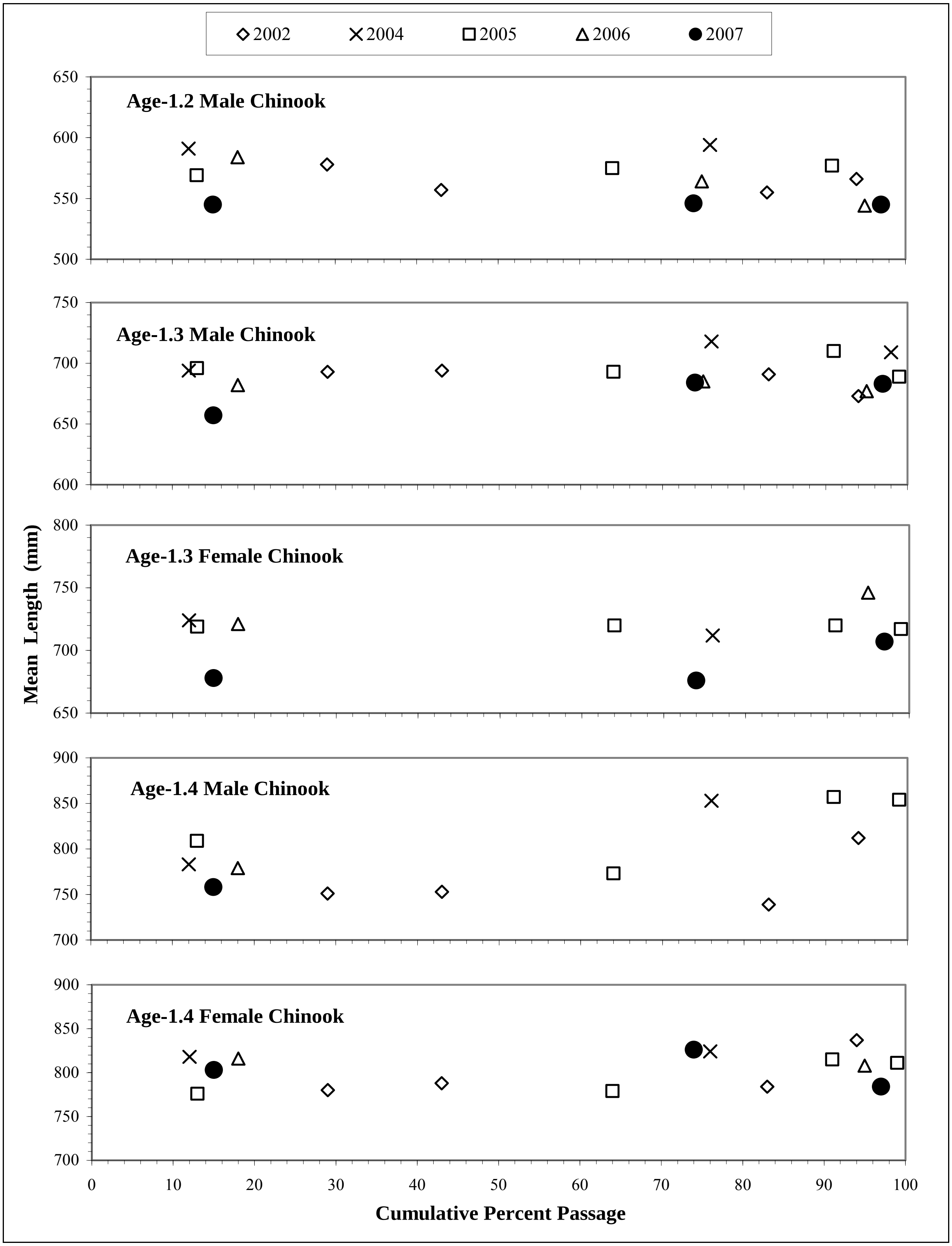
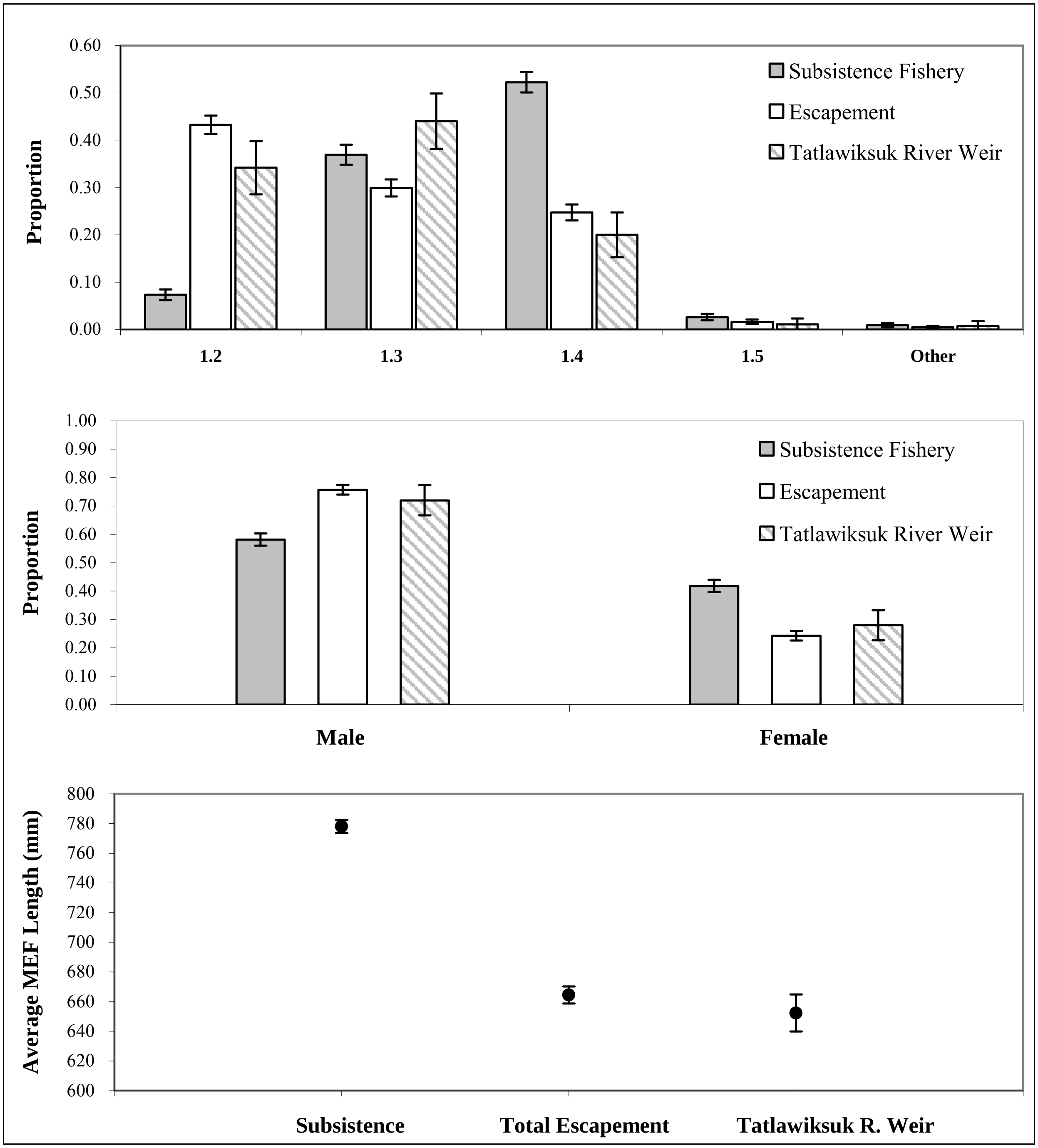


Figure 17.–Historical average annual length with 95% confidence intervals for Chinook salmon at the Tatlawiksuk River weir.



Note: Only samples greater than 6 fish were included in this figure.

Figure 18.–Historical mean length-at-age of male and female Chinook salmon by cumulative percent passage at Tatlawiksuk River weir.



Note: Few Chinook salmon were harvested in the coho salmon-directed commercial fishery in 2007; Chinook salmon samples were not collected.

Figure 19.–ASL composition of the 2007 Kuskokwim River Chinook salmon commercial and subsistence harvests, total monitored escapement, and the Tatlawiksuk River weir (+/- 95% confidence interval).

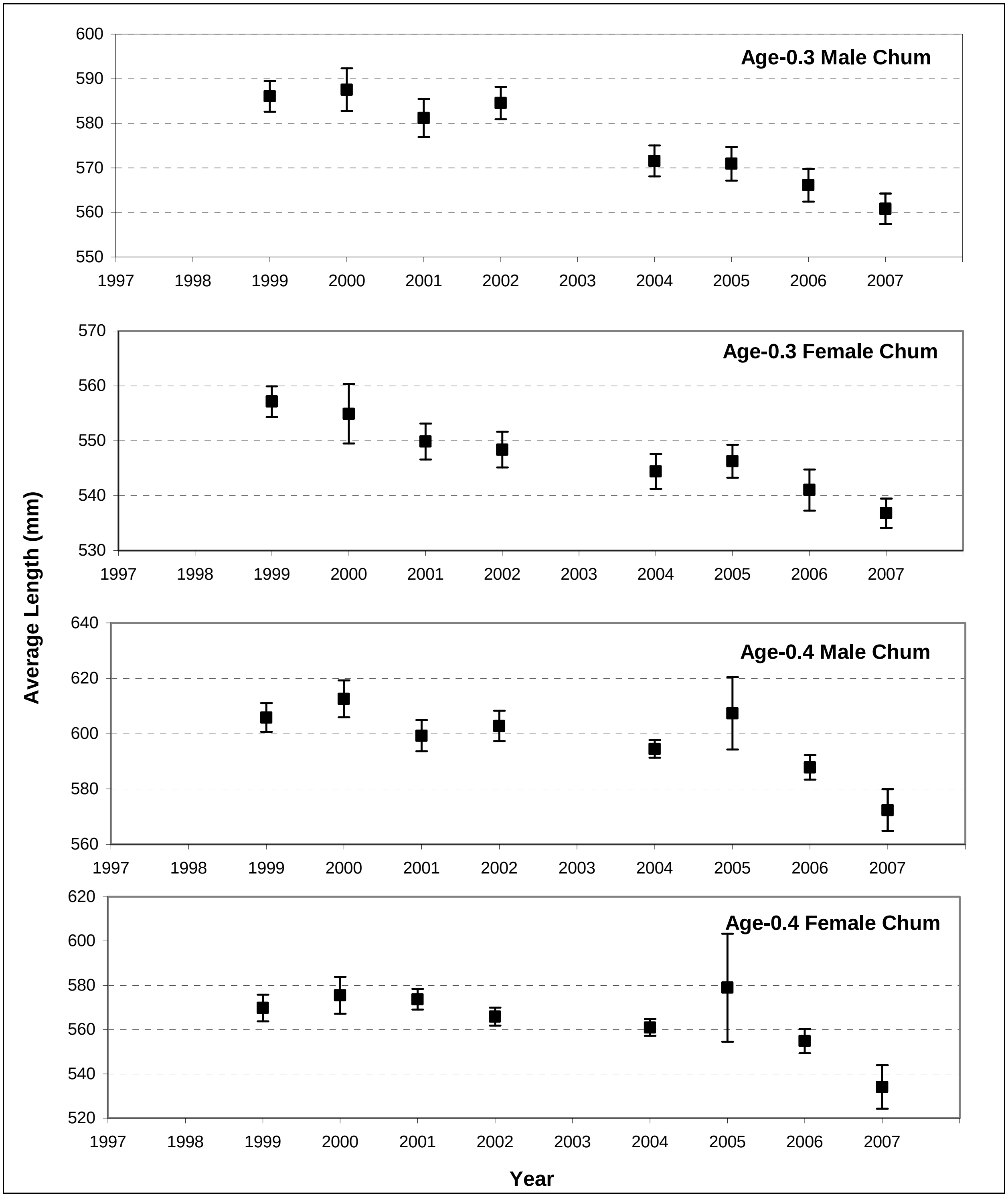


Figure 20.–Historical average annual length with 95% confidence intervals for chum salmon at the Tatlawiksuk River weir.

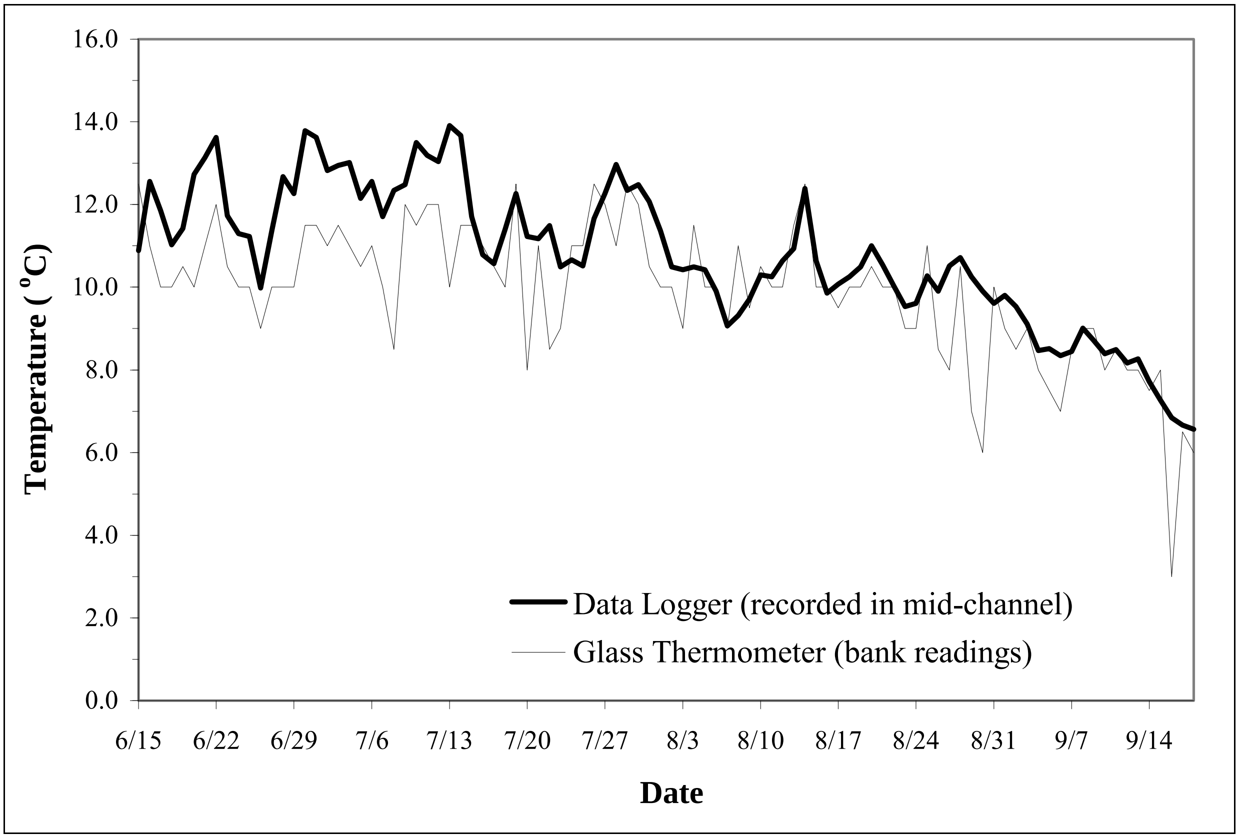
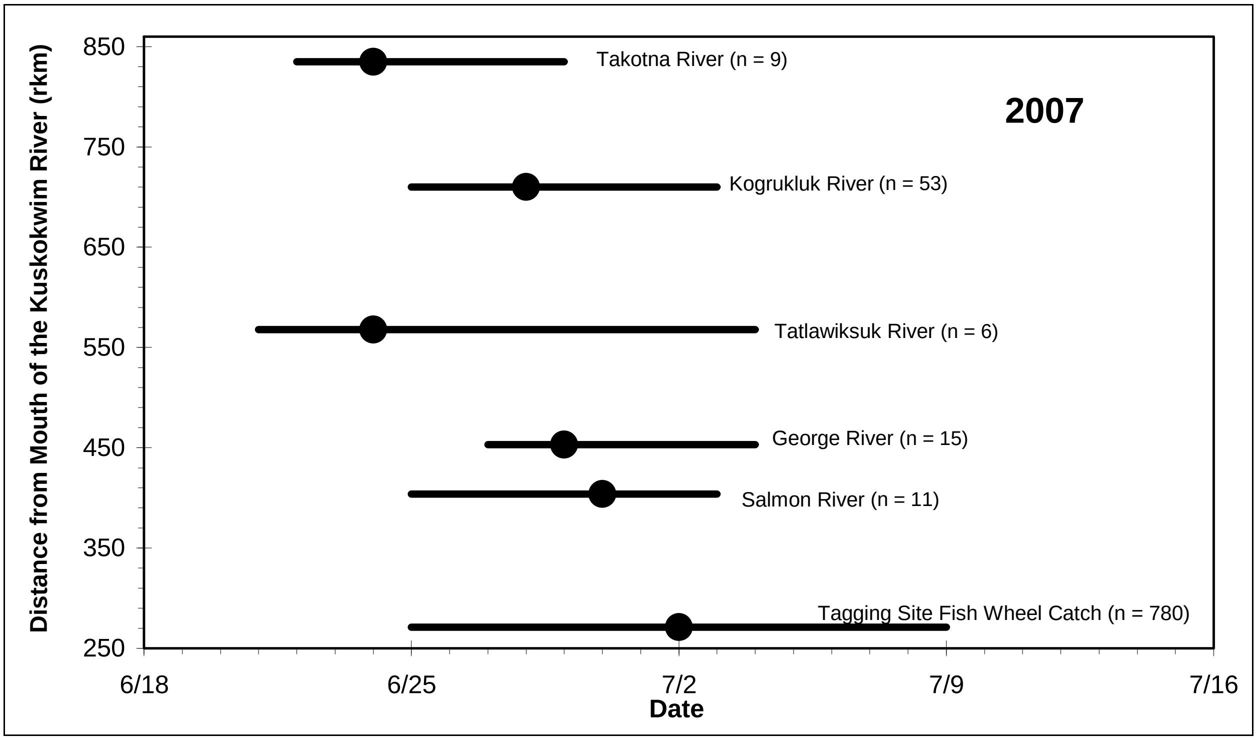


Figure 21.–Comparison of daily morning water temperature (9:00 AM) from a data logger installed near mid-channel with readings taken from a glass thermometer along the bank at Tatlawiksuk River weir in 2007.



Source: K. L. Schaberg, Commercial Fisheries Biologist, ADF&G, Anchorage; personal communication.

Note: Horizontal lines represent the central 50% of passage, and circles represent the median passage date for each stock.

Figure 22.–Dates when individual Chinook salmon stocks passed the Kalskag tagging sites (rkm 271) based on anchor- and radio-tagging studies conducted in 2007.

APPENDIX A. DAILY PASSAGE COUNTS

Appendix A1.–Daily fish passage counts at the Tatlawiksuk River weir, 2007.

Date	Chinook Salmon	Sockeye Salmon	Chum Salmon	Pink Salmon	Coho Salmon	Longnose Suckers	White-fish	Other[a]	
6/14	0	0	0	0	0	1	0	0	
6/15	0	0	0	0	0	1	0	0	
6/16	0	0	0	0	0	0	0	1	P
6/17	0	0	0	0	0	0	1	0	
6/18	0	0	0	0	0	3	0	0	
6/19	0	0	0	0	0	4	0	0	
6/20	0	0	2	0	0	39	1	1	G
6/21	0	0	3	0	0	111	1	1	P
6/22	0	0	0	0	0	75	2	0	
6/23	0	0	5	0	0	77	0	0	
6/24	0	0	15	0	0	45	0	0	
6/25	2	0	47	0	0	94	0	0	
6/26	8	0	53	0	0	35	3	0	
6/27	3	0	101	0	0	27	0	0	
6/28	23	0	242	0	0	99	0	2	G
6/29	1	0	73	0	0	22	0	1	P
6/30	0	0	143	0	0	7	0	2	G
7/1	92	0	785	0	0	73	1	0	
7/2	22	0	448	0	0	24	2	0	
7/3	72	0	1,142	0	0	43	2	1	P
7/4	83	0	1,650	0	0	63	0	0	
7/5	52	0	1,435	0	0	46	3	0	
7/6	46	0	1,898	0	0	6	1	0	
7/7	76	0	3,141	0	0	2	0	0	
7/8	269	0	3,732	0	0	40	1	0	
7/9	488	0	5,069	0	0	51	2	0	
7/10	147	0	4,034	0	0	78	0	0	
7/11	75	0	3,366	0	0	38	1	2	P
7/12	30	0	3,916	0	0	54	1	1	P
7/13	37	0	3,632	0	0	35	0	1	P
7/14	27	0	2,660	0	0	7	0	0	
7/15	70	0	2,755	0	0	9	0	0	
7/16	55	0	3,731	1	0	8	0	0	
7/17	52	0	3,232	0	0	2	0	0	
7/18	51	0	3,436	0	0	6	0	0	
7/19 [b]	16	0	1,092	0	0	1	0	0	
7/20	29	0	2,545	0	2	1	0	0	
7/21	21	0	2,409	0	3	3	0	0	
7/22	19	1	1,891	1	3	0	0	0	
7/23	15	1	1,718	1	1	0	0	0	
7/24	31	0	2,657	2	3	0	0	0	
7/25	37	0	2,398	1	3	0	0	0	
7/26	18	3	1,697	0	6	0	1	0	
7/27	11	1	2,266	1	13	0	1	0	
7/28	11	3	1,950	0	30	0	0	0	
7/29	6	1	1,291	0	10	0	0	0	
7/30	5	1	1,113	0	34	0	0	0	
7/31	5	0	1,024	0	38	0	0	0	
8/1	4	0	924	0	50	0	0	0	
8/2	3	1	911	0	23	0	0	0	
8/3	4	1	850	0	44	0	0	0	
8/4	4	1	719	0	59	0	0	0	
8/5	2	0	446	0	101	0	0	0	

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Date	Chinook Salmon	Sockeye Salmon	Chum Salmon	Pink Salmon	Coho Salmon	Longnose Suckers	White-fish	Other[a]
8/6 [c]	ND	ND	ND	ND	ND	ND	ND	ND
8/7 [c]	ND	ND	ND	ND	ND	ND	ND	ND
8/8 [c]	ND	ND	ND	ND	ND	ND	ND	ND
8/9 [c]	ND	ND	ND	ND	ND	ND	ND	ND
8/10 [c]	ND	ND	ND	ND	ND	ND	ND	ND
8/11 [c]	ND	ND	ND	ND	ND	ND	ND	ND
8/12	0	0	77	0	381	2	0	0
8/13	1	0	116	0	422	0	0	0
8/14	0	0	84	0	439	1	0	0
8/15	0	0	52	0	228	0	0	0
8/16	0	1	67	0	275	0	0	0
8/17	0	2	54	0	353	1	0	1 P
8/18	0	3	45	0	343	2	0	0
8/19	0	0	32	0	255	0	0	0
8/20	1	1	37	0	424	1	0	0
8/21	0	0	25	0	500	2	0	0
8/22	0	0	27	0	343	0	0	0
8/23	0	0	19	0	201	0	0	0
8/24	1	0	14	0	258	0	0	2 P
8/25	0	0	15	0	377	2	0	0
8/26	0	0	10	0	176	0	0	0
8/27	2	1	11	0	215	0	1	0
8/28	0	0	8	0	319	0	1	0
8/29	0	1	4	0	229	0	0	0
8/30	0	1	5	0	84	0	0	0
8/31	0	0	4	0	173	0	1	0
9/1	0	0	6	0	112	0	0	0
9/2	0	0	1	0	97	0	0	0
9/3	0	0	8	0	56	0	0	0
9/4	0	0	6	0	95	0	0	0
9/5	0	0	7	0	62	0	0	0
9/6	1	1	5	0	77	0	0	0
9/7	0	0	2	0	51	0	0	0
9/8	0	0	1	0	50	0	0	0
9/9	0	0	2	0	54	0	0	1 P
9/10 [b]	0	0	2	0	28	0	0	0
9/11	0	0	0	0	21	0	0	0
9/12	0	0	1	0	39	0	0	0
9/13	0	0	1	0	32	0	0	1 P
9/14	0	0	0	0	13	0	0	0
9/15	0	0	0	0	8	0	0	0
9/16 [d]	ND	ND	ND	ND	ND	ND	ND	ND
9/17 [d]	ND	ND	ND	ND	ND	ND	ND	ND
9/18 [d]	ND	ND	ND	ND	ND	ND	ND	ND
9/19 [d]	ND	ND	ND	ND	ND	ND	ND	ND
9/20 [d]	ND	ND	ND	ND	ND	ND	ND	ND

[a] Letter designations are as follows: P = Northern pike, G = Arctic grayling. Count may not correspond to actual day observed.

[b] Counts on this day were incomplete due to the occurrence of a hole in the weir.

[c] Weir was not operational due to extreme water level.

[d] Seasonal weir operation was terminated early.

APPENDIX B. HISTORICAL DAILY SALMON ESCAPEMENT AT TATLAWIKSUK RIVER WEIR

Appendix B1.–Historical daily Chinook salmon escapement at Tatlawiksuk River weir during the target operational period.

Date	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
6/15	0 [a]	0	0	0 [a]	0 [a]	0 [a]	2	0	0	0
6/16	0 [a]	0	0	0 [a]	0 [a]	0 [a]	2	0	0	0
6/17	0 [a]	0	0	0 [a]	0 [b]	0 [a]	0	0	0	0
6/18	0	0	2	0 [a]	0	0 [a]	4	1	0	0
6/19	0	0	2	0 [a]	0	0 [a]	8	1	0	0
6/20	1	0	0	0	0	0	3	1	0	0
6/21	0	0	0	1	1	0	2	6	0	0
6/22	0	0	1	2	19	6	1	7	0	0
6/23	8	4	0	1	67	0	0	3	0	0
6/24	12	2	10	3	3	5	11	6	0	0
6/25	7	2	0	5	2	13	74	5	1	2
6/26	12	6	20	71	8	19	241	27	3	8
6/27	37	4	2	18	517	3	21	10	22	3
6/28	31	14	5	38	21	152	84	5	3	23
6/29	23	5	2	15	195	297	75	5	4	1
6/30	5	2	22	105	25	57	43	192	42	0
7/1	99	16	26	364	15	41	315	24	23	92
7/2	182	5	149	24	84	8	131	74	21	22
7/3	171	13	47	27	108	96 [a]	86	481	5	72
7/4	224	26	30	13	135	29 [a]	165	248	128	83
7/5	74	14	42	111	338	59 [a]	243	239 [b]	47	52
7/6	62	15	17	428	64	42 [a]	7	87	187	46
7/7	22 [c]	14	18	170	145	13 [a]	84	140	35	76
7/8	[d]	13	13	21	10	27 [a]	106	98	78	269
7/9	[d]	21	73	29	24	129 [a]	229	112	228	488
7/10	[d]	40	51	29	27	35 [a]	165	95	146	147
7/11	[d]	79 [b]	45	14	48	35 [a]	43	143	46	75
7/12	[d]	118	50	48	19	34 [a]	16	101	111	30
7/13	[d]	54	9	150	20	88 [a]	98	86	59	37
7/14	[d]	64	0	48	21	65 [a]	29	123	52	27
7/15	[d]	24	8	47	103	38 [a]	31	35	41	70
7/16	[d]	65	20	12	10	28 [a]	47	96	36	55
7/17	[d]	6	47	19	15	18 [a]	161	70	23	52
7/18	[d]	146	5	31	3	22 [a]	53	65	65	51
7/19	[d]	20	8	36	15	30 [a]	17	80	52	38 [e]
7/20	[d]	381	10	17	8	72 [a]	12	52	29	29
7/21	[d]	18	2	8	14	9 [a]	22	36	24	21
7/22	[d]	9	16	21	29	15 [a]	21	24	15	19
7/23	[d]	86	7	11	13	17 [a]	26	10	29	15
7/24	[d]	46	5	13 [e]	7	25 [a]	19	15	21	31
7/25	[d]	33	8	9 [e]	18	16 [a]	13	11	10	37
7/26	[d]	18	2	6	4	14 [a]	14	11	5	18
7/27	[d]	14 [e]	3	5 [e]	24	14 [a]	26	5	20	11
7/28	[d]	10	1	2	20	16 [a]	19	12	8	11
7/29	[d]	22	1	8	10	13 [a]	9	14	17	6
7/30	[d]	15	6	3	5	8 [a]	2	12	11	5
7/31	[d]	6	1	5 [d]	6	16 [a]	15	8	10	5
8/1	[d]	6	2	4 [a]	1	6 [a]	0	3	11	4
8/2	[d]	1	3 [a]	3 [a]	5	8 [a]	1	7	8	3
8/3	[d]	4	8	2 [d]	0	6 [a]	2	5	5	4
8/4	[d]	3	2	2	1	2 [a]	4	0	3	4
8/5	[d]	5	0	1	0	2 [a]	6	7	2	2

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Date	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
8/6	[d]	3	1	1	0	4 [a]	5	2	6	3 [a]
8/7	[d]	2	1	2	1	2 [a]	3	3 [e]	4	2 [a]
8/8	[d]	4	3	2	0	2 [a]	4	2	2	2 [a]
8/9	[d]	0	1	0	1	2 [a]	0	0	1	2 [a]
8/10	[d]	1 [a]	1	1	0	2 [a]	2	0	1	1 [a]
8/11	[d]	1 [a]	1	0	0	1 [a]	3	0	0	1 [a]
8/12	[d]	1 [a]	0	2	1	3 [a]	0	0	0	0
8/13	[d]	1 [a]	1	1	0	3 [a]	1	1	0	1
8/14	[d]	1 [a]	2 [c]	0	0	2 [a]	0	1	0	0
8/15	[d]	1 [a]	1 [a]	0	2	1 [a]	0	2	0	0
8/16	[d]	1 [a]	1 [a]	0	0	1 [a]	1	1	0	0
8/17	[d]	1 [a]	0 [a]	0 [a]	0	1 [a]	0	0	0	0
8/18	[d]	1 [a]	0 [a]	0 [a]	0	1 [a]	0	1	0	0
8/19	[d]	1 [a]	1 [a]	0 [a]	1	1 [a]	0	0	0 [a]	0
8/20	[d]	0 [a]	0 [a]	0 [a]	0	2 [a]	0	1	0 [a]	1
8/21	[d]	0 [a]	0 [a]	0 [a]	1	1 [a]	3	0	0 [a]	0
8/22	[d]	0 [a]	1 [a]	0 [a]	0	1 [a]	1	0	0 [a]	0
8/23	[d]	0	0 [a]	0 [a]	0	1 [a]	0	1	0 [a]	0
8/24	[d]	1	0 [a]	0 [a]	0	0 [a]	0	1	0 [a]	1
8/25	[d]	0	1 [a]	0 [a]	0	0 [a]	0	1	0 [a]	0
8/26	[d]	0 [e]	0 [a]	1 [b]	0	0 [a]	0	1	0 [a]	0
8/27	[d]	0	0 [a]	0	0	0 [a]	0	0	0 [a]	2
8/28	[d]	0	0 [a]	0	0	0 [a]	1	0	0 [a]	0
8/29	[d]	0	0 [a]	0	0	0 [a]	0	0	0 [a]	0
8/30	[d]	0	0 [a]	0	0	0 [a]	0	0	0 [a]	0
8/31	[d]	0	0 [a]	0	0	0 [a]	0	0	0 [a]	0
9/1	[d]	1	0 [a]	0	0	0 [a]	1	0	0 [a]	0
9/2	[d]	0	0 [a]	0	1	0 [a]	0	0	0 [a]	0
9/3	[d]	0	0 [a]	0	0	0 [a]	0	0	0 [a]	0
9/4	[d]	0	0 [a]	0	0	0 [a]	0	0	0 [a]	0
9/5	[d]	0	0 [a]	0	0	0 [a]	0	0	0 [a]	0
9/6	[d]	0	0 [a]	0	1	0 [a]	0	0	0 [a]	1
9/7	[d]	0	0 [a]	0	0	0 [a]	0	0	0 [a]	0
9/8	[d]	0	0 [a]	0	1	0 [a]	0	0	0 [a]	0
9/9	[d]	0	0 [a]	0	0	0 [a]	0	0 [a]	0 [a]	0
9/10	[d]	0	0 [a]	0	0	0 [a]	0	0 [a]	0 [a]	0 [e]
9/11	[d]	0	0 [a]	0	0 [b]	0 [a]	0	0 [a]	0 [a]	0
9/12	[d]	0	0 [a]	0	0 [a]	0 [a]	0	0 [a]	0 [a]	0
9/13	[d]	0	0 [a]	0	0 [a]	0 [a]	0	0 [a]	0 [a]	0
9/14	[d]	0	0 [a]	0	0 [a]	0 [a]	0	0 [a]	0 [a]	0
9/15	[d]	0	0 [a]	0 [a]	0 [a]	0 [a]	0	0 [a]	0 [a]	0
9/16	[d]	0	0 [a]	0 [a]	0 [a]	0 [a]	0	0 [a]	0 [a]	0 [a]
9/17	[d]	0	0 [a]	0 [a]	0 [a]	0 [a]	0	0 [a]	0 [a]	0 [a]
9/18	[d]	0	0 [a]	0 [a]	0 [a]	0 [a]	0	0 [a]	0 [a]	0 [a]
9/19	[d]	0	0 [a]	0 [a]	0 [a]	0 [a]	0 [a]	0 [a]	0 [a]	0 [a]
9/20	[d]	0	0 [a]	0 [a]	0 [b]	0 [a]	0 [a]	0	0 [a]	0 [a]

[a] The weir was not operational; daily passage was estimated.
[b] Partial day count; passage was estimated.
[c] Partial day count; passage was not estimated.
[d] The weir was not operational; daily passage was not estimated.
[e] Daily passage was estimated due to the occurrence of a hole in the weir.

Appendix B2.–Historical daily chum salmon escapement at Tatlawiksuk River weir during the target operational period.

Date	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
6/15	0 [a]	0	1	0 [a]	1 [a]	[b]	9	0	0	0
6/16	0 [a]	0	1	0 [a]	2 [a]	[b]	15	3	0	0
6/17	0 [a]	0	0	0 [a]	4 [c]	[b]	7	0	0	0
6/18	0	0	2	0 [a]	2	[b]	22	2	3	0
6/19	0	0	0	0 [a]	6	[b]	75	10	0	0
6/20	0	0	0	0	3	0	105	4	0	2
6/21	5	0	2	3	42	0	53	9	3	3
6/22	4	0	7	4	168	1	81	13	12	0
6/23	12	0	1	30	262	5	71	7	58	5
6/24	25	18	18	22	28	6	169	32	115	15
6/25	26	7	30	61	103	4	594	15	234	47
6/26	65	18	97	131	483	12	450	36	265	53
6/27	197	25	7	69	392	20	175	43	441	101
6/28	275	67	10	143	574	106	176	56	267	242
6/29	195	67	3	133	834	71	266	130	464	73
6/30	146	58	88	368	634	135	378	366	1,369	143
7/1	464	91	176	440	424	78	462	213	458	785
7/2	529	86	492	143	1,037	41	690	1,605	208	448
7/3	556	101	280	171	501	[b]	660	2,380	764	1,142
7/4	1,005	110	147	162	759	[b]	525	1,110	2,190	1,650
7/5	1,011	94	325	488	1,278	[b]	482	1,387 [c]	347	1,435
7/6	757	141	155	618	1,762	[b]	235	993	1,109	1,898
7/7	454 [d]	171	175	778	809	[b]	638	1,063	745	3,141
7/8	[b]	158	109	900	666	[b]	811	1,439	845	3,732
7/9	[b]	324	462	1,061	840	[b]	836	1,748	2,141	5,069
7/10	[b]	391	247	1,399	828	[b]	627	1,546	1,791	4,034
7/11	[b]	404 [d]	391	596	1,238	[b]	425	2,741	1,018	3,366
7/12	[b]	416	611	1,179	869	[b]	502	2,775	1,365	3,916
7/13	[b]	280	169	1,199	702	[b]	967	2,610	1,003	3,632
7/14	[b]	361	33	1,301	707	[b]	759	3,095	504	2,660
7/15	[b]	268	266	1,330	1,123	[b]	642	2,780	491	2,755
7/16	[b]	377	367	1,092	677	[b]	829	3,283	929	3,731
7/17	[b]	339	257	1,201	959	[b]	863	2,370	979	3,232
7/18	[b]	404	183	1,607	880	[b]	800	2,260	799	3,436
7/19	[b]	160	144	859	707	[b]	655	2,115	1,059	2,906 [e]
7/20	[b]	663	88	699	468	[b]	573	2,156	1,106	2,545
7/21	[b]	306	176	761	504	[b]	557	2,196	1,215	2,409
7/22	[b]	275	238	650	515	[b]	495	1,422	924	1,891
7/23	[b]	628	158	614	409	[b]	513	1,491	962	1,718
7/24	[b]	322	152	511 [e]	251	[b]	463	1,152	755	2,657
7/25	[b]	338	114	391 [e]	206	[b]	474	1,138	734	2,398
7/26	[b]	205	85	270	195	[b]	359	1,144	612	1,697
7/27	[b]	214 [d]	122	206 [e]	301	[b]	421	794	503	2,266
7/28	[b]	222	93	169	224	[b]	344	807	543	1,950
7/29	[b]	130	94	178	159	[b]	304	732	597	1,291
7/30	[b]	285	141	230	144	[b]	123	680	578	1,113
7/31	[b]	141	72	190 [b]	119	[b]	322	587	378	1,024
8/1	[b]	171	41	176 [a]	99	[b]	151	344	232	924
8/2	[b]	125	37 [a]	163 [a]	59	[b]	124	440	216	911
8/3	[b]	141	18	149 [b]	54	[b]	85	486	124	850
8/4	[b]	60	15	131	64	[b]	93	266	104	719
8/5	[b]	57	8	139	98	[b]	117	265	72	446

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Date	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
8/6	[b]	35	9	96	44	[b]	87	227	115	513 [a]
8/7	[b]	43	12	95	55	[b]	99	196 [e]	101	444 [a]
8/8	[b]	24	5	62	72	[b]	134	122	73	374 [a]
8/9	[b]	42	2	69	30	[b]	43	168	108	305 [a]
8/10	[b]	30 [a]	5	36	37	[b]	44	105	22	235 [a]
8/11	[b]	28 [a]	7	38	22	[b]	45	62	88	166 [a]
8/12	[b]	26 [a]	8	38	25	[b]	26	93	33	77
8/13	[b]	24 [a]	9	27	13	[b]	13	63	21	116
8/14	[b]	22 [a]	10 [b]	19	5	[b]	22	59	3	84
8/15	[b]	20 [a]	4 [a]	23	13	[b]	19	55	1	52
8/16	[b]	17 [a]	4 [a]	8	8	[b]	14	44	4	67
8/17	[b]	15 [a]	4 [a]	14 [a]	8	[b]	7	16	10	54
8/18	[b]	13 [a]	2 [a]	13 [a]	15	[b]	5	28	4	45
8/19	[b]	11 [a]	6 [a]	12 [a]	1	[b]	14	19	17 [a]	32
8/20	[b]	9 [a]	14 [a]	11 [a]	2	[b]	20	6	11 [a]	37
8/21	[b]	7 [a]	8 [a]	9 [a]	1	[b]	9	12	11 [a]	25
8/22	[b]	4 [a]	0 [a]	8 [a]	2	[b]	12	33	20 [a]	27
8/23	[b]	1 [a]	2 [a]	7 [a]	0	[b]	9	17	1 [a]	19
8/24	[b]	1	0 [a]	6 [a]	2	[b]	4	13	3 [a]	14
8/25	[b]	0	6 [a]	4 [a]	2	[b]	7	1	1 [a]	15
8/26	[b]	2 [e]	2 [a]	3 [a]	2	[b]	5	5	3 [a]	10
8/27	[b]	2	2 [a]	2 [c]	0	[b]	4	5	0 [a]	11
8/28	[b]	0	2 [a]	1	0	[b]	3	5	3 [a]	8
8/29	[b]	0	2 [a]	0	2	[b]	3	4	3 [a]	4
8/30	[b]	0	2 [a]	0	1	[b]	0	3	3 [a]	5
8/31	[b]	1	0 [a]	0	2	[b]	1	2	0 [a]	4
9/1	[b]	0	4 [a]	0	2	[b]	6	0	0 [a]	6
9/2	[b]	1	0 [a]	2	1	[b]	0	1	3 [a]	1
9/3	[b]	0	2 [a]	1	0	[b]	2	1	1 [a]	8
9/4	[b]	0	0 [a]	0	0	[b]	2	2	3 [a]	6
9/5	[b]	1	2 [a]	0	1	[b]	1	3	3 [a]	7
9/6	[b]	2	0 [a]	0	0	[b]	2	1	1 [a]	5
9/7	[b]	0	0 [a]	0	0	[b]	3	1	0 [a]	2
9/8	[b]	0	0 [a]	0	0	[b]	0	2	0 [a]	1
9/9	[b]	0	0 [a]	0	0	[b]	0	0	1 [a]	2
9/10	[b]	0	0 [a]	0	0	[b]	0	1 [a]	0 [a]	2 [e]
9/11	[b]	0	0 [a]	0	0	[b]	2	1 [a]	0 [a]	0
9/12	[b]	0	0 [a]	0	1 [c]	[b]	1	1 [a]	0 [a]	1
9/13	[b]	0	0 [a]	0	0 [a]	[b]	1	1 [a]	0 [a]	1
9/14	[b]	0	0 [a]	0	0 [a]	[b]	1	1 [a]	0 [a]	0
9/15	[b]	0	0 [a]	0	0 [a]	[b]	2	1 [a]	0 [a]	0
9/16	[b]	0	0 [a]	0 [a]	0 [a]	[b]	1	1 [a]	1 [a]	0 [a]
9/17	[b]	0	0 [a]	0 [a]	0 [a]	[b]	0	1 [a]	0 [a]	0 [a]
9/18	[b]	0	0 [a]	0 [a]	0 [a]	[b]	0	1 [a]	0 [a]	0 [a]
9/19	[b]	0	0 [a]	0 [a]	0 [a]	[b]	0 [a]	1 [a]	0 [a]	0 [a]
9/20	[b]	0	0 [a]	0 [a]	0 [c]	[b]	0 [a]	0	0 [a]	0 [a]

[a] The weir was not operational; daily passage was estimated.

[b] The weir was not operational; daily passage was not estimated.

[c] Partial day count; passage was estimated.

[d] Partial day count; passage was not estimated.

[e] Daily passage was estimated due to the occurrence of a hole in the weir.

Appendix B3.–Historical daily coho salmon escapement at the Tatlawiksuk River weir during the target operational period.

Date	1998[a]	1999	2000	2001	2002	2003	2004	2005	2006	2007
6/15		0	0	0 [b]	0 [b]	[c]	0	0	0	0
6/16		0	0	0 [b]	0 [b]	[c]	0	0	0	0
6/17		0	0	0 [b]	0 [d]	[c]	0	0	0	0
6/18		0	0	0 [b]	0	[c]	0	0	0	0
6/19		0	0	0 [b]	0	[c]	0	0	0	0
6/20		0	0	0	0	0	0	0	0	0
6/21		0	0	0	0	0	0	0	0	0
6/22		0	0	0	0	0	0	0	0	0
6/23		0	0	0	0	0	0	0	0	0
6/24		0	0	0	0	0	0	0	0	0
6/25		0	0	0	0	0	0	0	0	0
6/26		0	0	0	0	0	0	0	0	0
6/27		0	0	0	0	0	0	0	0	0
6/28		0	0	0	0	0	0	0	0	0
6/29		0	0	0	0	0	0	0	0	0
6/30		0	0	0	0	0	0	0	0	0
7/1		0	0	0	0	0	0	0	0	0
7/2		0	0	0	0	0	0	0	0	0
7/3		0	0	0	0	[c]	0	0	0	0
7/4		0	0	0	0	[c]	0	0	0	0
7/5		0	0	0	0	[c]	0	0 [d]	0	0
7/6		0	0	0	0	[c]	0	0	0	0
7/7		0	0	0	0	[c]	0	0	0	0
7/8		0	0	0	0	[c]	0	0	0	0
7/9		0	0	0	0	[c]	0	0	0	0
7/10		0	0	0	0	[c]	0	0	0	0
7/11		0 [d]	0	0	0	[c]	0	0	0	0
7/12		0	0	0	0	[c]	0	0	0	0
7/13		0	0	0	0	[c]	0	0	0	0
7/14		0	0	0	0	[c]	0	0	0	0
7/15		0	0	0	0	[c]	0	0	0	0
7/16		0	0	0	0	[c]	0	0	1	0
7/17		0	0	0	0	[c]	0	0	0	0
7/18		0	0	0	0	[c]	0	1	0	0
7/19		0	2	0	0	[c]	0	0	1	1 [e]
7/20		0	0	0	0	[c]	1	0	9	2
7/21		0	1	0	0	[c]	0	0	17	3
7/22		0	0	0	0	[c]	3	2	14	3
7/23		0	0	0	0	[c]	6	1	4	1
7/24		0	1	0 [e]	0	[c]	7	6	9	3
7/25		1	0	0 [e]	0	[c]	3	8	2	3
7/26		0	0	0	0	[c]	19	16	2	6
7/27		1 [e]	0	0 [e]	3	[c]	31	21	7	13
7/28		2	3	1	3	[c]	22	16	16	30
7/29		9	2	0	3	[c]	18	19	26	10
7/30		1	25	8	8	[c]	15	37	30	34
7/31		1	11	18 [d]	3	[c]	106	38	57	38
8/1		0	40	29 [b]	5	[c]	55	20	52	50
8/2		0	110 [b]	42 [b]	11	[c]	93	29	50	23
8/3		0	172	54 [d]	16	[c]	98	70	39	44
8/4		0	215	42	4	[c]	128	36	55	59
8/5		2	173	91	33	[c]	214	36	47	101

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Date	1998[a]	1999	2000	2001	2002	2003	2004	2005	2006	2007
8/6		0	129	47	23	[c]	452	51	152	126 [b]
8/7		5	277	74	46	[c]	468	80 [e]	75	172 [b]
8/8		1	108	135	43	[c]	437	60	57	218 [b]
8/9		1	267	130	79	[c]	497	172	79	264 [b]
8/10		3 [b]	619	264	73	[c]	536	118	41	310 [b]
8/11		5 [b]	730	212	63	[c]	450	101	54	356 [b]
8/12		2 [b]	1,123	306	437	[c]	722	91	102	381
8/13		9 [b]	1,429	314	787	[c]	534	73	231	422
8/14		12 [b]	319 [f]	864	240	[c]	646	167	176	439
8/15		13 [b]	[c]	530	220	[c]	628	82	260	228
8/16		27 [b]	[c]	860	345	[c]	515	71	190	275
8/17		36 [b]	[c]	652 [b]	53	[c]	575	277	282	353
8/18		44 [b]	[c]	610 [b]	349	[c]	591	162	225	343
8/19		26 [b]	[c]	567 [b]	27	[c]	716	125	76 [b]	255
8/20		71 [b]	[c]	525 [b]	28	[c]	395	118	73 [b]	424
8/21		73 [b]	[c]	482 [b]	1,199	[c]	708	111	657 [b]	500
8/22		32 [b]	[c]	439 [b]	420	[c]	825	80	251 [b]	343
8/23		71 [b]	[c]	397 [b]	1,347	[c]	679	757	1,056 [b]	201
8/24		103	[c]	354 [b]	1,027	[c]	473	881	957 [b]	258
8/25		88	[c]	311 [b]	542	[c]	638	277	411 [b]	377
8/26		93 [e]	[c]	269 [b]	750	[c]	266	199	476 [b]	176
8/27		97	[c]	226 [d]	354	[c]	304	194	275 [b]	215
8/28		181	[c]	185	345	[c]	259	177	262 [b]	319
8/29		171	[c]	182	106	[c]	246	226	167 [b]	229
8/30		93	[c]	204	52	[c]	238	162	107 [b]	84
8/31		184	[c]	176	368	[c]	284	211	290 [b]	173
9/1		239	[c]	64	409	[c]	507	72	241 [b]	112
9/2		170	[c]	87	225	[c]	260	92	159 [b]	97
9/3		140	[c]	107	92	[c]	281	52	72 [b]	56
9/4		190	[c]	88	182	[c]	183	323	253 [b]	95
9/5		193	[c]	80	201	[c]	88	264	233 [b]	62
9/6		103	[c]	33	79	[c]	137	164	122 [b]	77
9/7		30	[c]	43	253	[c]	117	108	181 [b]	51
9/8		35	[c]	55	40	[c]	134	159	100 [b]	50
9/9		53	[c]	38	62	[c]	119	92	77 [b]	54
9/10		303	[c]	13	54	[c]	123	117 [b]	86 [b]	41 [e]
9/11		81	[c]	61	53	[c]	149	108 [b]	81 [b]	21
9/12		81	[c]	29	51 [d]	[c]	95	99 [b]	75 [b]	39
9/13		99	[c]	30	45 [b]	[c]	114	90 [b]	68 [b]	32
9/14		82	[c]	38	40 [b]	[c]	85	82 [b]	61 [b]	13
9/15		51	[c]	56	36 [b]	[c]	68	73 [b]	54 [b]	8
9/16		26	[c]	39 [b]	31 [b]	[c]	19	64 [b]	48 [b]	5 [b]
9/17		32	[c]	31 [b]	27 [b]	[c]	23	55 [b]	41 [b]	6 [b]
9/18		18	[c]	24 [b]	22 [b]	[c]	7	47 [b]	35 [b]	2 [b]
9/19		56	[c]	16 [b]	18 [b]	[c]	0 [b]	38 [b]	8 [b]	0 [b]
9/20		17	[c]	8 [b]	13 [d]	[c]	0 [b]	18	16 [b]	0 [b]

[a] The weir was not operated long enough to enumerate coho salmon in 1998.
[b] The weir was not operational; daily passage was estimated.
[c] The weir was not operational; daily passage was not estimated.
[d] Partial day count; passage was estimated.
[e] Partial day count; passage was not estimated.
[f] Daily passage was estimated due to the occurrence of a hole in the weir.

APPENDIX C. DAILY CARCASS COUNTS

Appendix C1.–Daily fish carcass counts at Tatlawiksuk River weir in 2007.

	Chinook Salmon			Sockeye Salmon			Chum Salmon			Pink Salmon			Coho Salmon			Longnose	White-	
Date	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Sucker	fish	Other[a]
6/15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0
6/17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
6/18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 P
6/20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2 P
6/21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 P
6/23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
6/24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 S
6/25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
6/26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2 P
6/28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1 P
7/2	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
7/3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/4	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	0	1 S
7/5	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
7/6	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	1	1	0
7/7	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
7/8	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1 P
7/9	0	0	0	0	0	0	5	7	12	0	0	0	0	0	0	5	1	0
7/10	0	0	0	0	0	0	5	5	10	0	0	0	0	0	0	2	2	1 P
7/11	0	0	0	0	0	0	7	5	12	0	0	0	0	0	0	1	2	0
7/12	0	0	0	0	0	0	4	3	7	0	0	0	0	0	0	5	0	0
7/13	1	2	3	0	0	0	17	8	25	0	0	0	0	0	0	6	2	1 P
7/14	1	2	3	0	0	0	10	9	19	0	0	0	0	0	0	2	2	0
7/15	0	0	0	0	0	0	23	16	39	0	0	0	0	0	0	8	2	0
7/16[b]	--	--	0	--	--	0	--	--	33	--	--	0	--	--	0	11	1	1 S
7/17	0	0	0	0	0	0	25	5	30	0	0	0	0	0	0	9	0	3 P
7/18	0	0	0	0	0	0	24	15	39	0	0	0	0	0	0	2	0	0
7/19	0	0	0	0	0	0	37	7	44	0	0	0	0	0	0	13	0	0
7/20	0	1	1	0	0	0	34	17	51	0	0	0	0	0	0	4	0	1 G
7/21	0	0	0	0	0	0	14	7	21	0	0	0	0	0	0	13	1	0

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Date	Chinook Salmon			Sockeye Salmon			Chum Salmon			Pink Salmon			Coho Salmon			Longnose	White-	
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Sucker	fish	Other[a]
7/22	0	0	0	0	0	0	45	18	63	0	0	0	0	0	0	20	1	0
7/23	0	0	0	0	0	0	46	26	72	0	0	0	0	0	0	15	0	1 P
7/24	1	0	1	0	0	0	49	16	65	0	0	0	0	0	0	12	0	1 P
7/25	0	0	0	0	0	0	22	7	29	0	0	0	0	0	0	11	1	0
7/26	0	0	0	0	0	0	40	14	54	0	0	0	0	0	0	12	1	0
7/27	0	0	0	0	0	0	40	14	54	0	0	0	0	0	0	12	1	0
7/28	3	1	4	0	0	0	50	14	64	0	0	0	0	0	0	2	1	2 P
7/29	1	0	1	0	0	0	32	12	44	0	0	0	0	0	0	5	4	0
7/30	2	0	2	1	0	1	42	15	57	0	0	0	0	0	0	6	7	1 S
7/31	0	1	1	0	0	0	72	19	91	0	0	0	0	0	0	5	6	1 P
8/1	1	1	2	0	0	0	45	18	63	0	0	0	0	0	0	3	2	0
8/2	2	0	2	0	0	0	50	72	122	0	0	0	0	0	0	12	1	0
8/3	1	0	1	0	0	0	73	18	91	0	0	0	0	0	0	9	5	1 P
8/4	2	0	2	0	0	0	58	15	73	0	0	0	0	0	0	8	5	0
8/5[b]	--	--	4	--	--	0	--	--	160	--	--	0	--	--	0	8	4	0
8/6[c]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
8/7[c]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
8/8[c]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
8/9[c]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
8/10[c]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
8/11[c]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
8/12	1	0	1	0	0	0	33	8	41	0	0	0	0	0	0	30	0	0
8/13[d]	3	0	3	0	0	0	39	9	48	0	0	0	0	0	0	36	3	1 G
8/14[d]	0	0	0	0	0	0	24	15	39	0	0	0	0	0	0	0	2	0
8/15[d]	0	0	0	0	0	0	14	10	24	0	0	0	0	0	0	0	2	0
8/16[d]	0	0	0	0	0	0	18	5	23	0	0	0	0	0	0	4	4	0
8/17[d]	0	0	0	0	0	0	12	2	14	0	0	0	0	0	0	2	0	0
8/18[d]	0	0	0	0	0	0	9	4	13	0	0	0	0	0	0	1	0	0
8/19[d]	0	0	0	0	0	0	20	7	27	0	0	0	0	0	0	1	0	0
8/20[d]	0	0	0	0	0	0	11	4	15	0	0	0	0	0	0	1	3	0
8/21[d]	0	0	0	0	0	0	10	3	13	0	0	0	0	0	0	0	12	1 P
8/22[d]	0	0	0	1	0	1	6	3	9	0	0	0	0	0	0	2	0	0
8/23[d]	1	0	1	0	0	0	4	1	5	0	0	0	0	0	0	1	0	0
8/24[d]	0	0	0	0	0	0	2	2	4	0	0	0	0	0	0	0	7	1 P
8/25[d]	0	0	0	0	0	0	5	4	9	0	0	0	0	0	0	2	4	1 P
8/26[d]	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	3	7	0

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Date	Chinook Salmon			Sockeye Salmon			Chum Salmon			Pink Salmon			Coho Salmon			Longnose	White-	
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Sucker	fish	Other[a]
8/27[d]	0	0	0	0	0	0	3	2	5	0	0	0	0	0	0	0	19	1 P
8/28[d]	0	0	0	0	0	0	3	1	4	0	0	0	0	0	0	0	11	0
8/29[d]	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	11	0
8/30[d]	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	3	4	0
8/31[d]	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	2	0
9/1[d]	0	0	0	0	0	0	2	1	3	0	0	0	0	0	0	0	2	0
9/2[d]	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0
9/3[d]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
9/4[d]	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	1 P
9/5[d]	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	0	0
9/6[d]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0
9/7[d]	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	3	2	0
9/8[d]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1 P
9/9	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
9/10[e]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
9/11[e]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
9/12	0	0	0	0	0	0	1	0	1	0	0	0	3	0	3	71	3	0
9/13[f]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
9/14[f]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
9/15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/16[g]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
9/17[g]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
9/18[g]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
9/19[g]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND
9/20[g]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	ND

[a] S = Sheefish; G = Arctic grayling; P = Northern pike.

[b] Heavy debris load made counting by sex impractical.

[c] Weir was not operational due to a high-water event.

[d] Downstream passage chutes were in place, thereby decreasing the carcass deposition.

[e] Carcasses were not counted due to high water but weir was still operational.

[f] It was not necessary to clean the weir; carcasses were not enumerated.

[g] Seasonal weir operation was terminated early.

APPENDIX D. WEATHER AND STREAM OBSERVATIONS

Appendix D1.–Daily weather and stream observations at the Tatlawiksuk River weir site, 2007.

Date	Time	Sky Conditions[a]	Precipitation (mm)[b]	Temperature (°C) Air	Temperature (°C) Water	River Stage (cm)	Water Clarity[c]
6/15	9:00	1	9.0	15.0	12.5	20	1
	17:00	ND		ND	ND	ND	ND
6/16	9:00	3	0.0	12.0	11.0	19	1
	17:00	4		14.0	12.0	19	1
6/17	9:00	4	4.8	8.0	10.0	19	1
	17:00	4		14.0	10.5	19	1
6/18	9:00	3	0.2	10.5	10.0	20	1
	17:00	3		17.5	12.0	20	1
6/19	9:00	3	0.0	11.5	10.5	21	1
	17:00	3		22.0	13.0	23	1
6/20	9:00	2	0.0	16.5	10.0	23	1
	17:00	3		23.0	10.0	22	1
6/21	9:00	4	1.0	12.0	11.0	22	1
	17:00	3		19.0	14.0	23	1
6/22	9:00	4	5.8	9.5	12.0	24	1
	17:00	4		12.0	12.0	25	1
6/23	9:00	4	9.0	9.0	10.5	27	1
	17:00	4		14.0	11.0	29	1
6/24	9:00	4	4.4	9.0	10.0	34	2
	17:00	3		14.0	12.0	35	2
6/25	9:00	4	1.0	9.0	10.0	39	2
	17:00	3		16.5	11.5	42	2
6/26	9:00	1	0.0	9.5	9.0	44	2
	17:00	3		19.0	12.0	42	2
6/27	9:00	2	0.0	10.0	10.0	39	1
	17:00	2		25.5	13.5	37	1
6/28	9:00	4	0.0	11.0	10.0	35	1
	17:00	4		17.0	12.0	33	1
6/29	9:00	1	0.0	11.0	10.0	32	1
	17:00	2		22.0	15.5	29	1
6/30	9:00	4	0.0	11.5	11.5	28	1
	17:00	3		19.0	15.0	27	1
7/1	9:00	4	0.0	12.0	11.5	24	1
	17:00	4		14.0	12.0	24	1
7/2	9:00	4	14.5	16.0	11.0	26	1
	17:00	4		20.0	14.0	27	1
7/3	9:00	4	1.1	14.0	11.5	36	2
	17:00	4		21.5	14.5	38	2
7/4	9:00	4	0.0	15.0	11.0	34	2
	17:00	4		18.0	13.0	34	2
7/5	9:00	3	0.3	13.0	10.5	31	1
	17:00	2		19.5	13.5	30	1
7/6	9:00	4	0.4	11.5	11.0	29	1
	17:00	4		15.0	9.5	30	1
7/7	9:00	4	0.9	13.0	10.0	30	1
	17:00	3		20.0	16.0	30	1
7/8	9:00	3	0.0	15.0	8.5	29	1
	17:00	4		18.0	13.0	28	1
7/9	9:00	4	0.1	14.0	12.0	28	1
	17:00	2		23.0	15.5	26	1
7/10	9:00	4	0.0	14.0	11.5	26	1
	17:00	4		17.5	14.0	25	1

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Date	Time	Sky Conditions[a]	Precipitation (mm)[b]	Temperature (°C) Air	Temperature (°C) Water	River Stage (cm)	Water Clarity[c]
7/11	9:00	4	5.5	14.5	12.0	26	1
	17:00	3		17.5	13.5	26	1
7/12	9:00	4	0.0	13.5	12.0	32	1
	17:00	3		23.5	16.0	32	1
7/13	9:00	4	0.0	14.0	10.0	30	1
	17:00	3		19.5	16.0	28	1
7/14	9:00	4	15.0	10.5	11.5	28	1
	17:00	4		13.0	11.5	29	1
7/15	9:00	4	16.0	11.0	11.5	39	1
	17:00	3		15.5	12.0	52	2
7/16	9:00	4	2.0	11.5	11.0	66	3
	17:00	3		17.0	16.0	68	3
7/17	9:00	2	0.0	11.5	10.5	68	3
	17:00	3		16.0	12.5	65	2
7/18	9:00	2	0.4	11.0	10.0	60	1
	17:00	2		23.5	14.0	57	1
7/19	9:00	4	1.5	12.0	12.5	53	1
	17:00	4		17.0	13.0	52	1
7/20	9:00	4	0.6	13.0	8.0	50	1
	17:00	3		19.0	13.0	49	1
7/21	9:00	1	0.0	12.5	11.0	47	1
	17:00	3		17.0	12.0	45	1
7/22	9:00	4	3.2	10.0	8.5	42	1
	17:00	4		12.0	12.0	41	1
7/23	9:00	3	2.3	10.0	9.0	41	1
	17:00	4		15.0	11.5	41	1
7/24	9:00	4	4.6	12.5	11.0	43	1
	17:00	3		16.0	15.0	44	1
7/25	9:00	3	0.0	11.0	11.0	47	1
	17:00	3		22.0	16.0	44	1
7/26	9:00	2	0.0	17.0	12.5	43	1
	17:00	3		25.0	15.0	43	1
7/27	9:00	3	0.0	15.0	12.0	41	1
	17:00	3		24.0	16.0	40	1
7/28	9:00	4	0.0	14.5	11.0	37	1
	17:00	3		18.0	14.0	37	1
7/29	9:00	4	0.0	11.5	12.5	35	1
	17:00	4		17.0	14.0	35	1
7/30	9:00	4	3.1	13.0	12.0	34	1
	17:00	4		16.5	13.0	34	1
7/31	9:00	4	8.0	13.0	10.5	33	1
	17:00	4		15.0	11.5	37	1
8/1	9:00	4	0.9	11.5	10.0	36	1
	17:00	4		16.0	11.5	39	1
8/2	9:00	4	0.0	12.0	10.0	39	1
	17:00	4		15.0	11.0	38	1
8/3	9:00	4	5.5	11.5	9.0	38	1
	17:00	4		15.0	11.0	36	1
8/4	9:00	4	10.0	11.5	11.5	36	1
	17:00	4		14.0	11.5	38	1
8/5	9:00	4	38.0	13.0	10.0	48	1
	17:00	4		14.0	11.0	56	1

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Date	Time	Sky Conditions[a]	Precipitation (mm)[b]	Temperature (°C) Air	Water	River Stage (cm)	Water Clarity[c]
8/6	9:00	4	0.0	12.0	10.0	107	3
	17:00	4		13.5	10.0	125	3
8/7	9:00	4	0.2	10.0	9.0	149	3
	17:00	3		17.0	10.0	158	3
8/8	9:00	3	0.0	13.0	11.0	163	3
	17:00	3		20.0	12.0	161	3
8/9	9:00	1	0.0	11.0	9.5	147	3
	17:00	1		23.5	12.5	140	3
8/10	9:00	1	0.0	10.0	10.5	130	2
	17:00	1		24.0	13.0	124	2
8/11	9:00	3	0.0	8.0	10.0	118	1
	17:00	3		23.0	13.0	106	1
8/12	9:00	4	9.0	14.0	10.0	97	1
	17:00	4		22.5	11.0	93	1
8/13	9:00	1	1.9	17.5	11.5	93	1
	17:00	3		27.0	14.0	90	1
8/14	9:00	4	0.8	10.5	12.5	83	1
	17:00	4		13.5	12.5	82	1
8/15	9:00	4	0.1	11.5	10.0	78	1
	17:00	4		15.0	11.0	73	1
8/16	9:00	4	12.0	12.0	10.0	79	1
	17:00	2		19.0	11.0	84	1
8/17	9:00	1	0.7	11.5	9.5	91	1
	17:00	2		22.5	11.5	91	1
8/18	9:00	2	2.0	10.0	10.0	88	1
	17:00	3		19.0	12.0	86	1
8/19	9:00	4	0.2	11.5	10.0	84	1
	17:00	4		20.0	12.0	82	1
8/20	9:00	4	0.0	10.5	10.5	78	1
	17:00	4		17.0	12.0	74	1
8/21	9:00	4	0.5	9.0	10.0	70	1
	17:00	3		17.0	11.0	66	1
8/22	9:00	4	3.0	10.0	10.0	68	1
	17:00	4		14.0	11.0	70	1
8/23	9:00	5	1.6	7.5	9.0	67	1
	17:00	3		17.5	10.5	66	1
8/24	9:00	3	0.0	11.0	9.0	65	1
	17:00	3		20.0	11.0	65	1
8/25	9:00	3	0.5	10.0	11.0	61	1
	17:00	3		19.0	11.0	61	1
8/26	9:00	5	0.0	6.0	8.5	57	1
	17:00	2		22.0	7.0	55	1
8/27	9:00	5	0.1	8.5	8.0	54	1
	17:00	2		20.0	9.5	52	1
8/28	9:00	3	0.4	8.5	10.5	49	1
	17:00	3		19.0	11.5	47	1
8/29	9:00	5	1.6	7.0	7.0	47	1
	17:00	2		17.0	12.0	47	1
8/30	9:00	3	8.6	10.5	6.0	47	1
	17:00	4		14.0	10.0	47	1
8/31	9:00	4	2.0	10.0	10.0	50	1
	17:00	2		17.0	11.0	54	1

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Appendix D1.–Page 4 of 4.

Date	Time	Sky Conditions[a]	Precipitation (mm)[b]	Temperature (°C) Air	Water	River Stage (cm)	Water Clarity[c]
9/1	9:00	5	0.2	9.0	9.0	56	1
	17:00	3		15.5	10.0	56	1
9/2	9:00	4	3.2	11.0	8.5	54	1
	17:00	3		16.0	10.0	54	1
9/3	9:00	4	1.8	7.5	9.0	55	1
	17:00	4		14.5	9.5	58	1
9/4	9:00	4	0.4	8.0	8.0	63	1
	17:00	2		19.0	11.0	65	1
9/5	9:00	2	0.0	4.5	7.5	57	1
	17:00	3		15.0	9.0	56	1
9/6	9:00	4	0.0	6.0	7.0	51	1
	17:00	4		13.5	9.0	50	1
9/7	9:00	3	0.8	9.0	8.5	47	1
	17:00	3		15.5	9.0	46	1
9/8	9:00	4	15.5	10.5	9.0	46	1
	17:00	4		15.0	10.0	49	1
9/9	9:00	4	8.5	10.0	9.0	59	1
	17:00	3		15.0	10.0	82	2
9/10	9:00	2	0.0	6.5	8.0	92	3
	17:00	4		18.0	9.0	94	3
9/11	9:00	4	0.0	7.0	8.5	91	3
	17:00	4		15.0	9.0	87	2
9/12	9:00	4	9.8	9.0	8.0	78	2
	17:00	3		13.5	9.0	77	2
9/13	9:00	4	1.5	9.0	8.0	86	2
	17:00	4		11.0	9.0	89	2
9/14	9:00	4	3.2	7.0	7.5	98	3
	17:00	3		11.5	8.5	98	3
9/15	9:00	3	0.0	4.0	8.0	94	3
	17:00	3		12.0	8.0	91	3
9/16	9:00	3	0.0	8.0	3.0	85	3
	17:00	3		11.0	7.5	80	3
9/17	9:00	4	3.2	7.0	6.5	76	2
	17:00	4		11.0	8.0	74	1
9/18	9:00	4	8.5	7.0	6.0	72	1
	17:00	4		9.5	7.0	76	1

[a] Sky condition codes:
- 0 = no observation
- 1 = clear or mostly clear; <10% cloud cover
- 2 = partly cloudy; <50% cloud cover
- 3 = mostly cloudy; >50% cloud cover
- 4 = complete overcast
- 5 = thick fog

[b] Represents cumulative precipitation in the previous 24 hours.

[c] Water clarity codes.
- 1 = visibility greater than 1 meter
- 2 = visibility between 0.5 and 1 meter
- 3 = visibility less than 0.5 meter

Appendix D2.–Daily summary of stream temperatures recorded hourly from a data logger installed at Tatlawiksuk River weir, 2007.

	Temperature (°C)		
Date	Avg.	Min.	Max.
6/15	12.6	10.8	15.2
6/16	13.6	12.6	14.6
6/17	12.4	11.8	13.5
6/18	12.0	11.0	13.1
6/19	12.9	11.4	14.5
6/20	13.9	12.7	15.4
6/21	14.4	13.1	15.9
6/22	13.9	13.3	15.5
6/23	12.4	11.7	13.2
6/24	12.1	11.3	12.8
6/25	11.6	11.1	12.5
6/26	11.3	10.0	12.9
6/27	12.8	11.3	14.7
6/28	13.6	12.6	14.4
6/29	13.9	12.3	15.8
6/30	14.9	13.7	16.2
7/1	14.3	13.6	15.5
7/2	13.4	12.8	14.1
7/3	13.7	12.9	14.8
7/4	13.6	13.0	14.5
7/5	13.0	12.1	14.1
7/6	12.9	12.5	13.8
7/7	12.7	11.7	13.9
7/8	13.4	12.3	14.3
7/9	13.8	12.4	15.7
7/10	14.4	13.5	15.2
7/11	14.0	13.1	14.9
7/12	14.4	13.0	16.2
7/13	14.9	13.9	15.9
7/14	13.8	13.0	15.2
7/15	12.1	11.6	12.9
7/16	11.4	10.8	11.9
7/17	11.6	10.6	12.7
7/18	12.4	11.3	13.6
7/19	12.6	12.2	13.0
7/20	12.1	11.2	13.1
7/21	12.2	11.2	13.2
7/22	11.8	11.4	12.6
7/23	11.1	10.5	11.9
7/24	11.2	10.7	12.0
7/25	11.7	10.5	13.3
7/26	12.6	11.7	13.8
7/27	13.6	12.3	15.2
7/28	13.8	13.0	14.6
7/29	13.1	12.3	13.8
7/30	12.9	12.5	13.4
7/31	12.4	12.1	13.1
8/1	11.6	11.3	12.3
8/2	10.8	10.5	11.2
8/3	10.8	10.4	11.2
8/4	10.7	10.5	11.1
8/5	10.6	10.4	10.9
8/6	10.0	9.8	10.7
8/7	9.3	9.0	9.7
8/8	9.7	9.3	10.1
8/9	10.4	9.7	11.5
8/10	11.0	10.2	11.7
8/11	10.8	10.2	11.3
8/12	11.0	10.6	11.8
8/13	11.9	10.9	13.1
8/14	12.4	11.7	13.0
8/15	10.9	10.6	11.6
8/16	10.4	9.9	11.2
8/17	10.8	10.1	11.6
8/18	10.9	10.2	11.4
8/19	11.2	10.5	12.2
8/20	11.5	11.0	11.9
8/21	10.9	10.5	11.3
8/22	10.4	10.0	10.9
8/23	10.2	9.5	10.9
8/24	10.4	9.6	11.3
8/25	10.8	10.2	11.4
8/26	10.8	9.9	12.0
8/27	11.2	10.5	12.1
8/28	11.4	10.7	12.2
8/29	11.0	10.2	12.0
8/30	10.3	9.9	11.2
8/31	10.1	9.6	10.9
9/1	10.1	9.8	10.5
9/2	10.0	9.5	10.4
9/3	9.5	9.1	9.9
9/4	9.2	8.5	10.1
9/5	9.1	8.5	9.6
9/6	8.8	8.3	9.3
9/7	9.0	8.4	9.7
9/8	9.2	9.0	9.5
9/9	9.0	8.7	9.5
9/10	8.8	8.3	9.3
9/11	8.6	8.4	8.9
9/12	8.5	8.2	9.1
9/13	8.3	8.1	8.8
9/14	7.9	7.7	8.1
9/15	7.5	7.2	8.0
9/16	7.1	6.8	7.3
9/17	6.8	6.6	7.0
Average:	11.5	10.8	12.3
Minimum:	6.8	6.6	7.0
Maximum:	14.9	13.9	16.2

Appendix D3.–Photograph showing the benchmark (river level = 300 cm) established in 2005, and located in the panel storage area at Tatlawiksuk River weir.

APPENDIX E. BROOD TABLES

Appendix E1.–Brood table for Tatlawiksuk River Chinook salmon.

Brood Years	Escapement (spawners)	Number by Age in Return Year					Returns[a]	Return per Spawner[a]
		3	4	5	6	7		
1991	ND	ND	ND	ND	ND	-	-	-
1992	ND	ND	ND	ND	-	-	-	-
1993	ND	ND	ND	-	-	-	-	-
1994	ND	ND	-	-	-	-	-	-
1995	ND	-	-	-	-	81	-	-
1996	ND	-	-	-	1,183	-	-	-
1997	ND	-	-	450	-	0	-	-
1998	- [b]	-	517	-	932	42	-	-
1999	1,490 [c]	0	-	1,150	1,040	78	-	-
2000	817 [c]	-	751	1,445	516	28	2,740 [d]	3.35 [d]
2001	2,010 [c]	0	391	749	406	ND	-	-
2002	2,237	0	357	904	ND	ND	-	-
2003	1,683 [c]	0	715	ND	ND	ND	-	-
2004	2,833	8	ND	ND	ND	ND	-	-
2005	2,918	ND	ND	ND	ND	ND	ND	ND
2006	1,700	ND	ND	ND	ND	ND	ND	ND
2007	2,061	ND	ND	ND	ND	ND	ND	ND

[a] Returns do not include downstream harvest.
[b] Insufficient escapement data.
[c] Insufficient age data.
[d] Does not include any possible 3 year old fish.

Appendix E2.–Brood table for Tatlawiksuk River chum salmon.

Brood Years	Escapement (spawners)	Number by Age in Return Year				Returns[a]	Return per Spawner[a]
		3	4	5	6		
1992	ND	ND	ND	ND	-	-	-
1993	ND	ND	ND	-	29	-	-
1994	ND	ND	-	2,660	34	-	-
1995	ND	-	6,959	2,781	93	-	-
1996	ND	10	4,011	7,941	364	12,326	-
1997	ND	139	15,582	8,158	-	-	-
1998	5,726 [b]	100	14,379	-	43	-	-
1999	9,559	1,641	-	9,150	0	-	-
2000	7,044	-	8,942	3,027	85	-	-
2001	23,718	3,110	49,802	13,675	479	67,066	2.83
2002	24,542	2,893	17,945	13,177	ND	-	-
2003	479 [b]	596	66,804	ND	ND	-	-
2004	24,201	2,786	ND	ND	ND	-	-
2005	55,720	ND	ND	ND	ND	ND	ND
2006	32,301	ND	ND	ND	ND	ND	ND
2007	83,246	ND	ND	ND	ND	ND	ND

[a] Returns do not include downstream harvest.

[b] Insufficient age data.

Appendix E3.–Brood table for Tatlawiksuk River coho salmon.

Brood Years	Escapement (spawners)	Number by Age in Return Year			Returns[a]	Return per Spawner[a]
		3	4	5		
1994	ND	ND	ND	445	-	-
1995	ND	ND	2,740	-	-	-
1996	ND	278	-	691	-	-
1997	ND	-	9,580	1,087	-	-
1998	ND	231	10,191	ND	-	-
1999	3,455	134	ND	416	-	-
2000	- [b]	ND	15,485	7,496	-	-
2001	10,539 [c]	510	6,727	-	-	-
2002	11,345	330	-	595	-	-
2003	ND	-	7,643	ND	-	-
2004	16,410	447	ND	ND	-	-
2005	7,495	ND	ND	ND	ND	ND
2006	- [b]	ND	ND	ND	ND	ND
2007	8,685	ND	ND	ND	ND	ND

[a] Returns do not include downstream harvest.

[b] Insufficient escapement data.

[c] Reported escapement includes 46% passage estimates.